Fundamentals of Residential Electrical System Design in High-Rise Development

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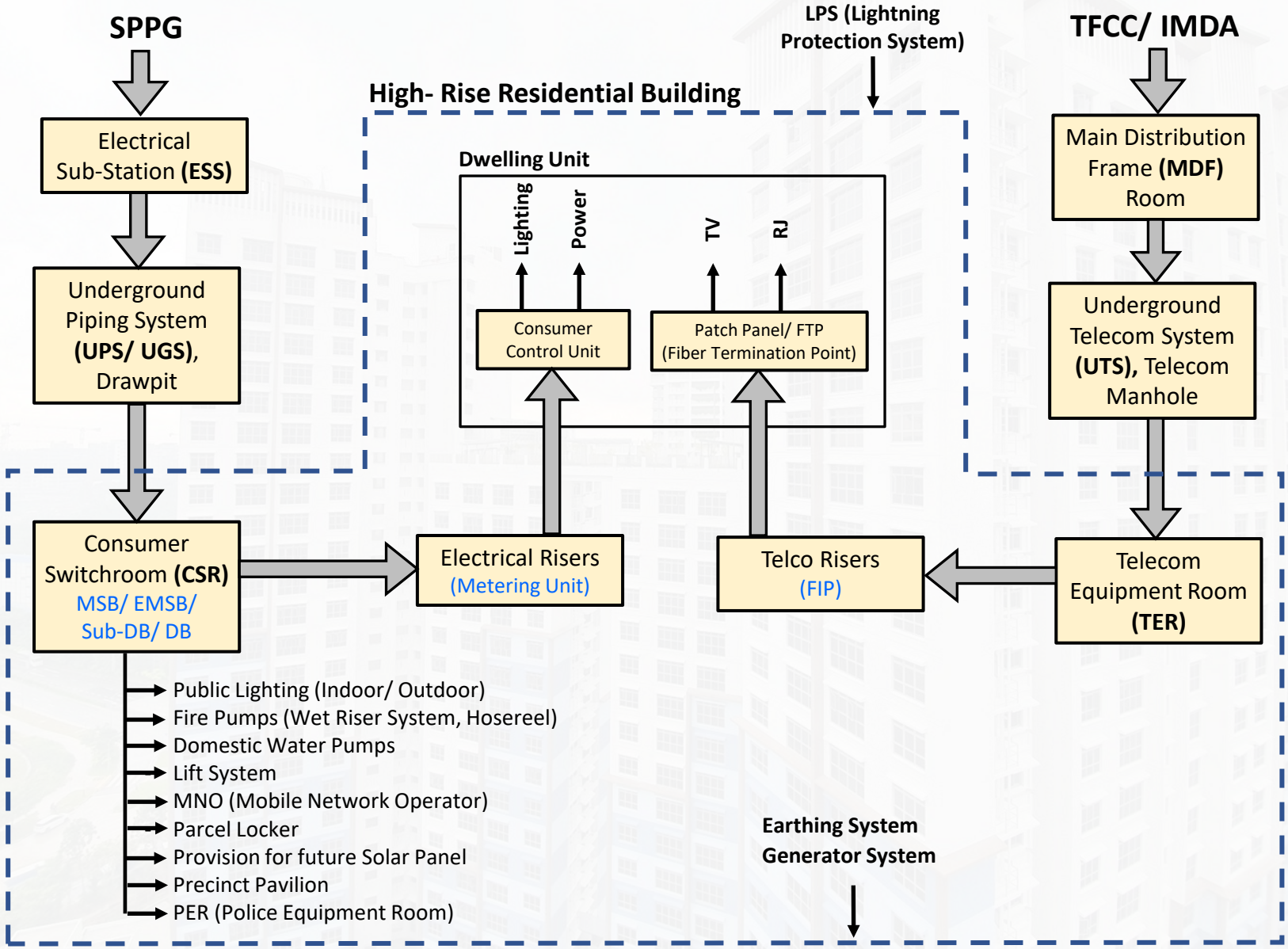
Electrical System Structure



Typical M&E Rooms Provisions for High-Rise Developments

BLOCK 1 (30 STOREYS)					
HT (m)	LEVEL	2R T2 Rental	2R T2	4R	NO. OF UNITS
8.50	RL		M&E AND LIFT OVERRUN		
2.8	LVL 30	2	5	7	14
2.8	LVL 29	2	5	7	14
2.8	LVL 28	2	5	7	14
2.8	LVL 27	2	5	7	14
2.8	LVL 26	2	5	7	14
2.8	LVL 25	2	5	7	14
2.8	LVL 24	2	5	7	14
2.8	LVL 23	2	5	7	14
2.8	LVL 22	2	5	7	14
2.8	LVL 21	2	5	7	14
2.8	LVL 20	2	5	7	14
2.8	LVL 19	2	5	7	14
2.8	LVL 18	2	5	7	14
2.8	LVL 17	2	5	7	14
2.8	LVL 16	2	5	7	14
2.8	LVL 15	2	5	7	14
2.8	LVL 14	2	5	7	14
2.8	LVL 13	2	5	7	14
2.8	LVL 12	2	5	7	14
2.8	LVL 11	2	5	7	14
2.8	LVL 10	2	5	7	14
2.8	LVL 09	2	5	7	14
2.8	LVL 08	2	5	7	14
2.8	LVL 07	2	5	7	14
2.8	LVL 06	2	5	7	14
2.8	LVL 05	2	5	7	14
2.8	LVL 04	2	5	7	14
2.8	LVL 03	2	5	7	14
2.8	LVL 02	2	5	7	14
4.5	LVL 01				
94.2	108.2 SHD				
TOTAL		58	145	203	406

BLOCK 2 (30 STOREYS)			
HT (m)	LEVEL	2R T1	NO. OF UNITS
8.50	RL	M&E AND LIFT OVERRUN	
2.8	LVL 30	9	9
2.8	LVL 29	9	9
2.8	LVL 28	9	9
2.8	LVL 27	9	9
2.8	LVL 26	9	9
2.8	LVL 25	9	9
2.8	LVL 24	9	9
2.8	LVL 23	9	9
2.8	LVL 22	9	9
2.8	LVL 21	9	9
2.8	LVL 20	9	9
2.8	LVL 19	9	9
2.8	LVL 18	9	9
2.8	LVL 17	9	9
2.8	LVL 16	9	9
2.8	LVL 15	9	9
2.8	LVL 14	9	9
2.8	LVL 13	9	9
2.8	LVL 12	9	9
2.8	LVL 11	9	9
2.8	LVL 10	9	9
2.8	LVL 09	9	9
2.8	LVL 08	9	9
2.8	LVL 07	9	9
2.8	LVL 06	9	9
2.8	LVL 05	9	9
2.8	LVL 04	9	9
2.8	LVL 03	9	9
2.8	LVL 02	9	9
4.5	LVL 01	VOID DECK	
94.2	108.2 SHD		
TOTAL		261	261

At 1st Storey:

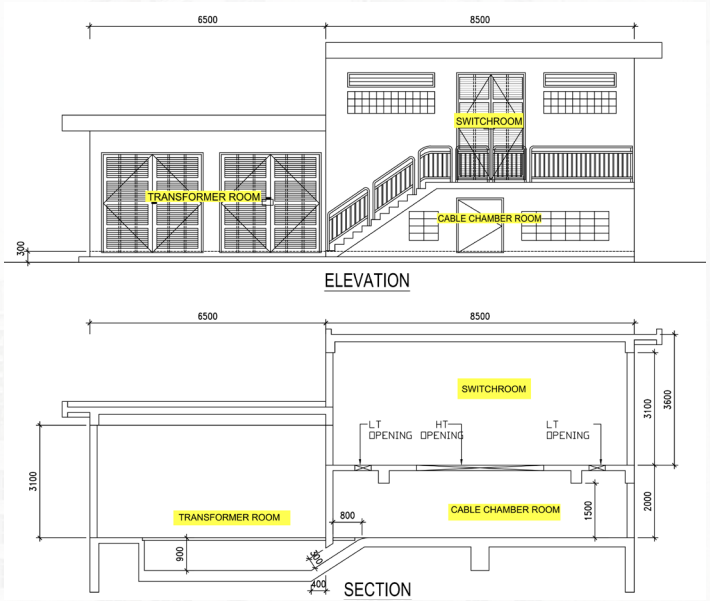
ESS (Electrical Substation)
CSR (Consumer Switchroom)
MDF Room (Main Distribution Frame)
TER (Telecommunication Equipment Room)
PER (Police Equipment Room)
WRT (Wet Riser Transfer Tank & Pump Room)
DWT (Domestic Water Transfer Tank & Pump Room)

At Roof Storey:

LMR (Lift Motor Room)
WR (MP) (Wet Riser Main Tank & Pump Room)
DWT (MP) (Domestic Water Main Tank & Pump Room)
HR (Hosereel Tank & Pump Room)

Electrical Substation (ESS)

ESS Building will build and handover by the Consumer (Owner) to SPPG. All the electrical equipments will be supplied, installed and maintained by **SPPG (SP PowerGrid).**



Typical SPPG Workflow during Design Stage:

- CS2 Pre-consultation
- CS1 Electrical Supply Connection Application
- Substation Plan Submission
- LT Reticulation Plan Submission

Electrical Substation (ESS)

HV/ LV Switchgear Room

Cable Chamber Room

Transformer Room

Electrical Installation

UPS (Underground Piping System)

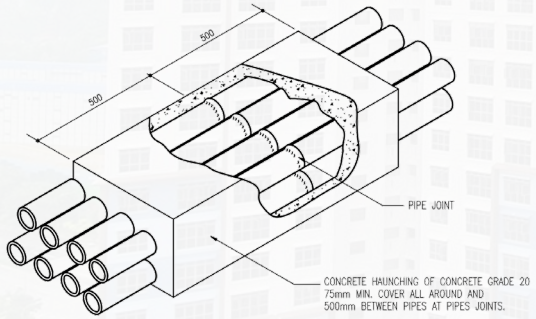
Is a network of interconnecting UPVC pipes, drawpits and all other accessories.

All HDB development shall be designed so that the service connection cables will be supplied, installed and maintained by SP with the following conditions:

a) Consumer Switchroom (CSRs) **shall be same level** with ESS (Electrical Substation).

b) Applied load > 560kVA (800A) ESS and CSR **shall be integrated or abutted** into the building block. ESS and CSR shall be abutted to 22kV/ LV Switchgear room.

a) Length of underground service connection cables **shall not be more than 270m** (including 30m slack).



UPS Layout (Normal Power Supply)- From ESS to CSR

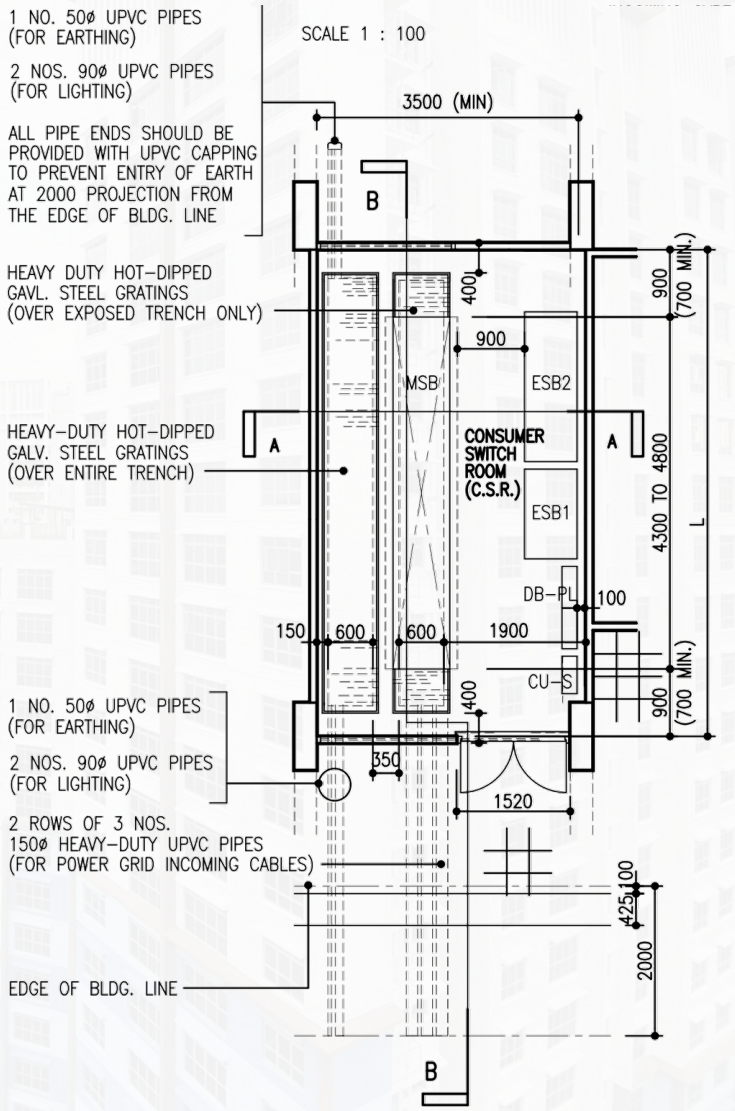
2 ROWS OF 6 NOS. EACH 150MM DIA. HD uPVC PIPE C/W WITH DRAW WIRES ENCASED IN CONCRETE WITH PVC COVER PLATE
2 ROWS OF 9 NOS. EACH 150MM DIA. HD uPVC PIPE C/W WITH DRAW WIRES ENCASED IN CONCRETE WITH PVC COVER PLATE
2 ROWS OF 3 NOS. EACH 150MM DIA. HD uPVC PIPE C/W WITH DRAW WIRES ENCASED IN CONCRETE WITH PVC COVER PLATE
2 ROWS OF 3 NOS. EACH 150MM DIA. HD uPVC PIPE C/W WITH DRAW WIRES ENCASED IN CONCRETE WITH PVC COVER PLATE
2 ROWS OF 6 NOS. EACH 150MM DIA. HD uPVC PIPE C/W WITH DRAW WIRES ENCASED IN CONCRETE WITH PVC COVER PLATE
2 ROWS OF 3 NOS. EACH 150MM DIA. HD uPVC PIPE C/W WITH DRAW WIRES ENCASED IN CONCRETE WITH PVC COVER PLATE
2 ROWS OF 6 NOS EACH 150mmØ HD uPVC PIPES C/W DRAW WIRES ENCASED IN CONCRETE WITH PVC COVER PLATE TO BE TERMINATED 300mm AFTER THE ROADSIDE DRAIN AND IT SHALL EXTENDED TO THE PUBLIC ROAD WHERE REQUIRED BY SPPG. ALL ENTRY PIPES TO BE SEALED WITH REMOVABLE WATER-TIGHT AND GAS-TIGHT MATERIAL AT BOTH ENDS UPON CABLE INSTALLATION (BY BUILDER) FOR INCOMING HT NETWORK.
PLANTING
1.5M RETAINING WALL
1:25.000
OUT
IN
ESS
MSCP
BLOCK 1
BLOCK 2
WRT
DWT
CSR-1
CSR-2
CSR-3
CSR
MDF
TER
PER
DP
EFS
2-5 PG
6-12 PG
AES
PP
PRECINCT PAVILION
PPSO
3M PLANTING STRIP
5M PLANTING STRIP
6M WIDE RVC

Consumer Switchroom (CSR)

- Refers to the electrical room where the consumer's main incoming low-voltage (LV) electrical switchboard and associated equipment are installed.

- Receive incoming electrical power from the ESS and distribute power to the building's sub-main distribution boards

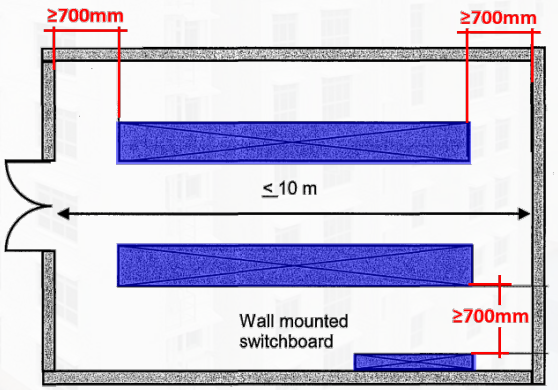
- Every block which has an official IRAS address shall have at least one CSR located at the ground floor and not under any wet area.



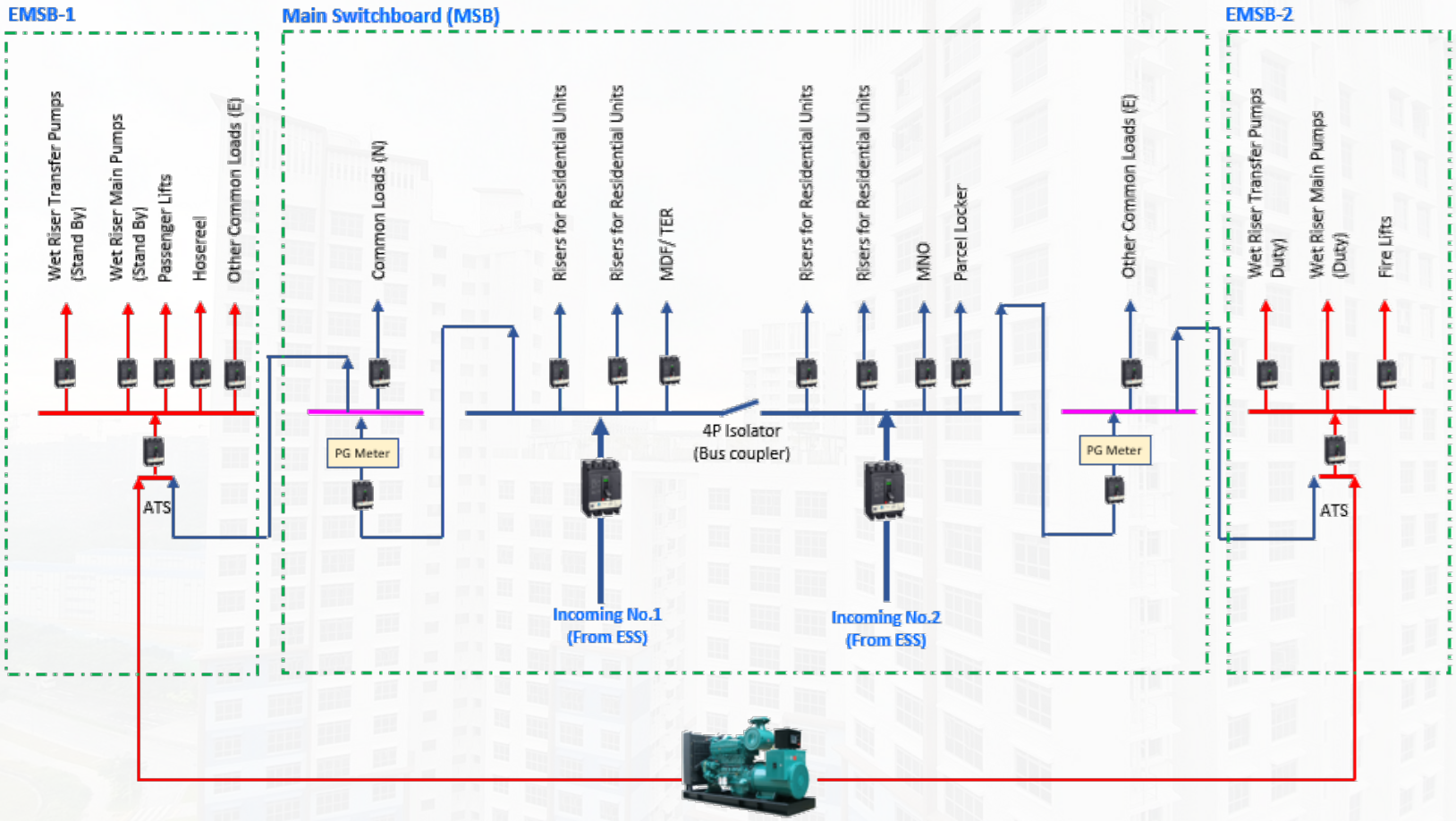
Main Switchboard (MSB)

1. **830kVA** Maximum Applied Load for each MSB.
2. Double Intake with Coupler
3. Provided with integrated Power Consumption and Fault Detection Monitoring System **(PCFDMS)**
4. Molded Case Circuit Breakers **(MCCB)** shall be used for Incoming Feeders
5. Surge Protective Devices **(SPD)**
6. **Metering Scheme**: Metered-Unmetered
7. **700mm clearance**
8. **Rating of MCCB** for SP Incoming for Residential Block

Applied Load (Residential) (kVA)	Main Incoming MCCB rating
Up to 277	300 A
278 to 416	400 A
417 to 554	600 A
555 to 831	800 A

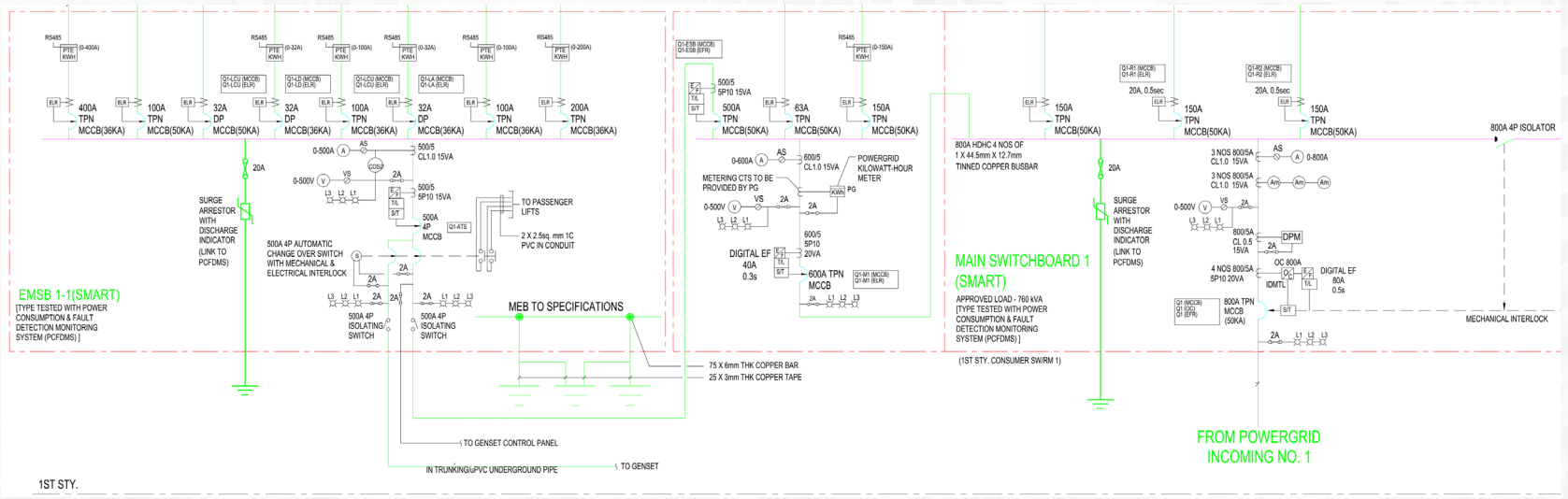


Typical Single Line Diagram of Main Switchboard



Protection Setting

Description	Protection	Setting
Main Inc.	OC & EF	OC:100% of Plug Setting. TMS:0.1 EF:20% of approved load subject to a maximum of 120 Amp with time lag of no more than 0.5sec
MSB Outgoing Fdr. Pumps & Lifts	MCCB ELR	ELR
MSB Outgoing Fdr. to Indoor/Outdoor Public Ltg DB	MCCB ELR	ELR 0.03-3A (adjustable)
Public Ltg Indoor DB PL	MCCB RCCB	<30mA RCCB (Branch Ltg) Indoor Lighting: 1 no. 1 phase 30mA - RCD connected to 30 lighting points (2ft LED) (max. 30 lighting points per phase) Roof small garden: 30mA DP RCCB-5 lamp pole per phase
Public Ltg Outdoor DB L (Driveway/Landscape/E-deck, Carpark Roof Garden etc.)	MCCB RCCB	100mA RCCB (Branch Ltg) Outdoor Lighting: 1 no. 3 phase 100mA - RCCB connected up to 15 lamp poles (max. 5 lamp pole per phase)

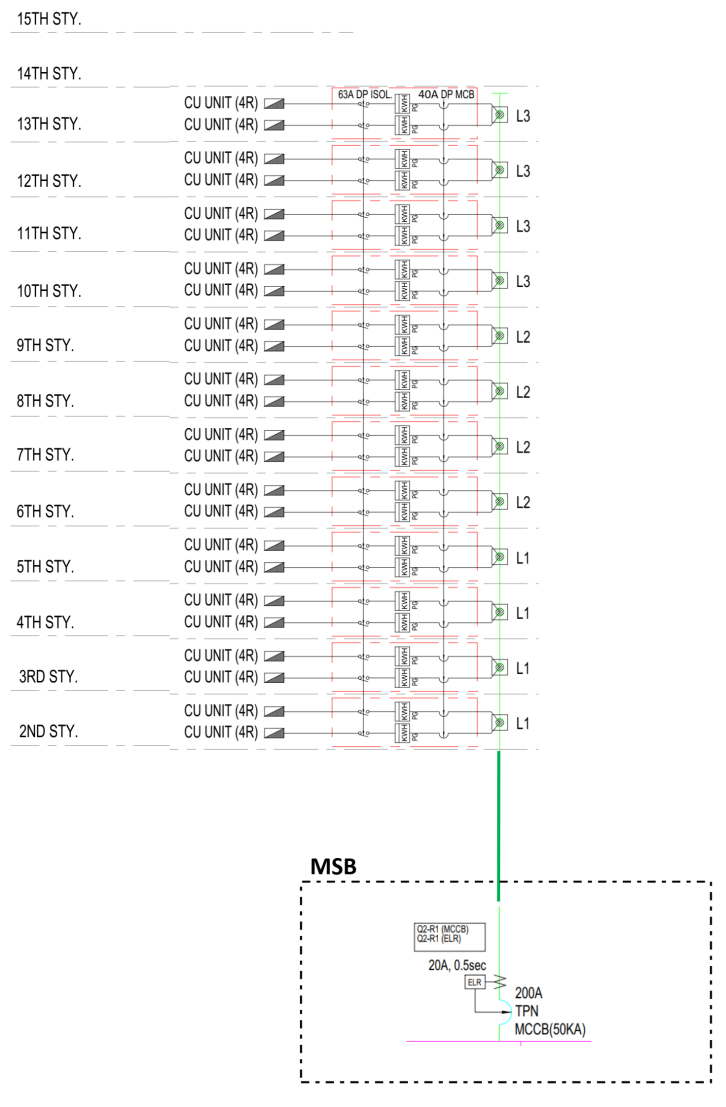

EMSB 1-1(SMART)
[TYPE TESTED WITH POWER CONSUMPTION & FAULT DETECTION MONITORING SYSTEM (PCFDMS)]
MAIN SWITCHBOARD 1 (SMART)
APPROVED LOAD - 760 kVA
[TYPE TESTED WITH POWER CONSUMPTION & FAULT DETECTION MONITORING SYSTEM (PCFDMS)]
(1ST STY. CONSUMER SW/RM 1)
MEB TO SPECIFICATIONS
75 X 6mm THK COPPER BAR
25 X 3mm THK COPPER TAPE
TO GENSET CONTROL PANEL
IN TRUNKING/UPVC UNDERGROUND PIPE
TO GENSET
FROM POWERGRID INCOMING NO. 1
MECHANICAL INTERLOCK
1ST STY.

Rating of MCCB for Riser serving the Dwelling Units/ Flats

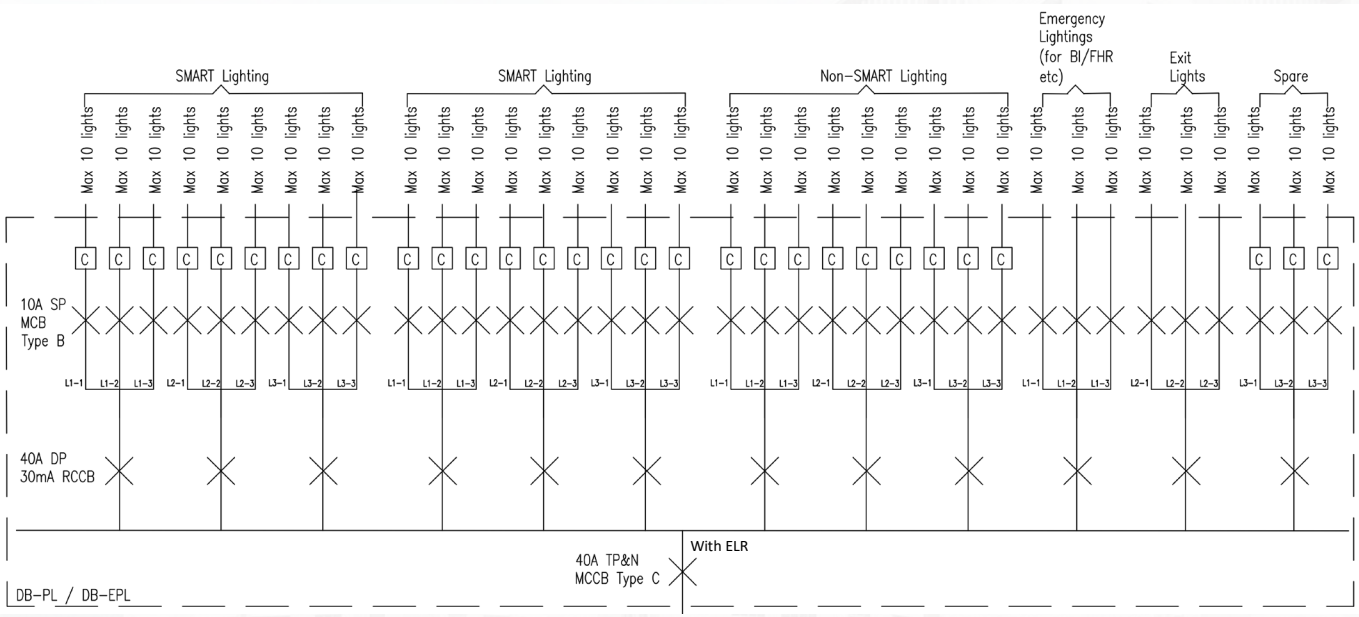
	Number of flats for each MCCB (phase) can serve					
MCCB	1Rm	2Rm	3Rm	4Rm	5Rm	3Gen Rm
200A	≤16	≤14	≤12	≤10	≤10	≤6
150A	≤12	≤8	≤8	≤6	≤6	≤4
100A	≤5	≤5	≤3	≤3	≤3	≤2

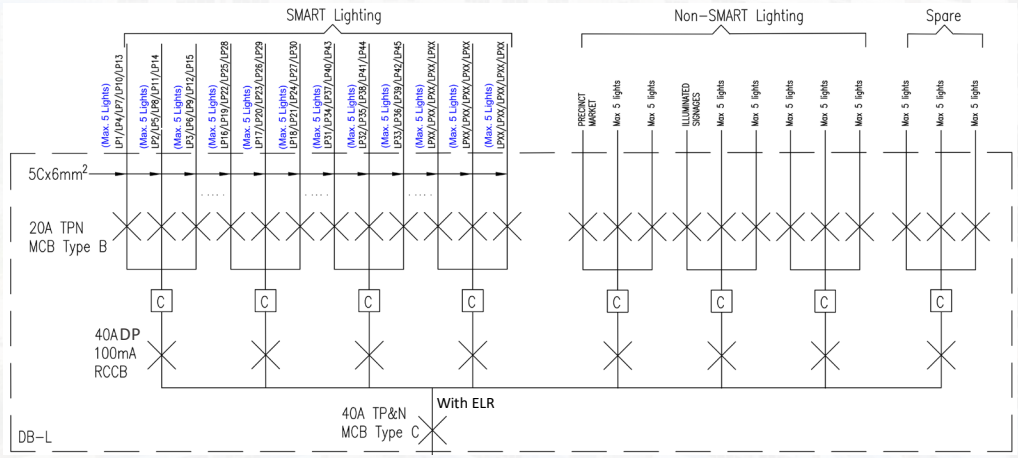
Estimated kVA Load per each Dwelling Unit Type

Unit Type	kVA	Incoming MCB
Rental Flat (1-rm/2-rm)	3.5kVA	40A DP
2-room Flat (Flexi)	3.5kVA	40A DP
3-room Flat	3.8kVA	40A DP
4-room Flat	4.3kVA	40A DP
5-room Flat	4.5kVA	40A DP
Multi-Generation Flat (MGF)	5.4kVA	60A DP



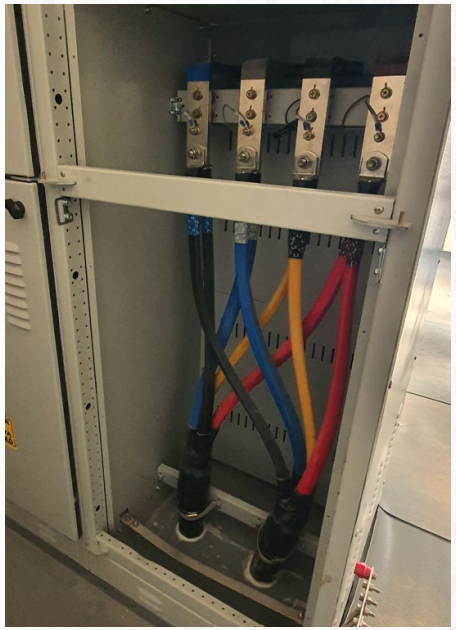
Sample Single Line Diagram for Public Lighting DB





Size of Incoming Cables to MSB at CSR

LT cable size		**Remarks**
New Build Residential Project		
Applied Load (KVA)	**Size of Cables**	
Up to 277	2 x 1 x 300mm^2/ 4C Al	
278 to 416	2 x 1 x 300mm^2/ 4C Cu	
417 to 554	2 x 2 x 300mm^2/ 4C Al	
555 to 831	2 x 2 x 300mm^2/ 4C Cu	
New Build Non-Residential Project (refer to SP Guideline "How to Apply For Electricity Connection" Appendix 36)		Carpark (CP), PWCS Centre, Commercial etc.
Applied Load (KVA)	**Size of Cables**	
46 to 75	35mm^2/ 4C Cu	
76 to 140	120mm^2/ 4C Al	
141 to 180	185mm^2/ 4C Al	
181 to 230	300mm^2/ 4C Al	
231 to 280	300mm^2/ 4C Cu	
281 to 460	2x300mm^2/ 4C Al	
461 to 560	2x300mm^2/ 4C Cu	
561 to 1000*	7x500mm^2/ 1C Cu	ESS to be abutted to the block CSR
1001 to 2000*	2x7x500mm^2/ 1C Cu	ESS to be abutted to the block CSR



Types of Cables

Phase cable	Earth cable	Location
CU/PVC/PVC	PVC (yellow/green)	Submain cables (<50mm^2) to DB
CU/PVC	PVC (yellow/green)	Submain cables in conduit to light/small power
CU/XLPE/PVC	XLPE/PVC (yellow/green)	Submain cables (≥50mm^2) to Flat
	PVC (yellow/green)	
CU/PVC/SWA/PVC	PVC	Underground generator cables
CU/XLPE/SWA/PVC	XLPE (yellow/green)	Underground Lamp Post Ltg cable
CU/FR (Fire Resistant Cables)	CU/LSZH Flame Retardant Cable (yellow/green)	Outgoing cables to Lift & firefighting equipment

To DB's & Sub- DB's

Final Circuit Cables

Cables from MSB to Electrical Risers

From Genset to EMSB

From ESS to CSR, Pole Lighting

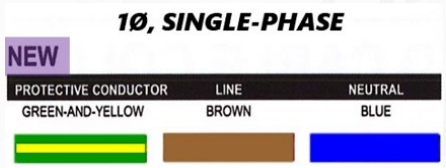
Cable Sizing for Earthing

S (mm^2) Cross. Sectional Line Conductor	Protective Conductor Same material as Line Conductor	Protective Conductor not the same material as Line Conductor
S≤16	S	k1/k2 x S
16<S≤35	16	k1/k2 x 16
S>35	S/2	k1/k2 x S/2

k1- Value of k for the line conductor

k2- Value of k for the earth conductor

Cable Colour Coding



Sample Electrical Load Tabulation (Part 1)

Type of Installation	Electrical Design Load per unit (KVA)	Type of Installation	Electrical Design Load per set of installation (KVA)
2 Room flat (Type 1)	3.5	Public Lighting Circuit (Landscape) at Block 2	41.2
2 Room flat (Type 2)	3.5	Public Lighting Circuit (Landscape) at Block 2	41.2
2 Room Rental Flat	3.5	Public Lighting Circuit (Landscape) at Block 3	17.6
4 Room Flat	4.3	Public Lighting Circuit (Service Road & Driveway) at Blk 1	6.0
		Public Lighting Circuit (Service Road & Driveway) at Blk 3	6.0
Childcare Centre, - 0.74A/ m2, 1Phase (880m2) at SCF Block	149.8	Public Lighting Circuit (Service Road & Driveway) at MSCP	48.0
Precinct Pavillion (200m2) at Blk 1	34.0	Public Lighting Circuit (Carpark) at MSCP	38.8
MNO (63A TPN) at Blk 3	43.6		
Parcel Locker (20A DP) at Blk 3	4.6	Others:	
Provision for TER (32A DP), at Blk 1 & 3	7.4	Power & Public Lighting (Void Deck) at Blk 1	31.8
Provision for MDF (32A TPN) at Blk 2	11.1	Power & Public Lighting (Void Deck) at Blk 2	28.2
		Power & Public Lighting (Void Deck) at Blk 3	26.5
		Power & Public Lighting (Corridor) at Blk 1	58.8
		Power & Public Lighting (Corridor) at Blk 2	52.9
		Power & Public Lighting (Corridor) at Blk 3	52.9
		Power & Public Lighting (Staircase) (Typical set for Blk 1, 2 & 3)	10.6
		Power & Public Lighting (Staircase) at MSCP	3.0
		Lift Lobby Lightings (Typical set for Blk 1, 2 & 3)	4.9
		Lift Lobby Lightings (Typical set for MSCP)	1.5
		Power & Public Lighting (at MSCP Roof Garden)	45.9
		Passenger Lift at Resi Block (Typical set for Blk 1, 2 & 3)	22.0
		Fire Lift at Resi Block (Typical set for Blk 1, 2 & 3)	22.0
		Passenger Lift at MSCP	15.0
		M&E Rooms at Blk 1	2.2
		M&E Rooms at Blk 2	3.1
		M&E Rooms at Blk 3	2.4
		M&E Rooms at MSCP	1.8
		M&E Rooms at CCC/ FAAC	0.4
		Domestic Transfer Pump (Typical set for Blk 1, 2 & 3)	18.0
		Domestic Booster Pump (Typical set for Blk 1, 2 & 3)	0.9
		Hose Reel Fire Fighting Pump (Typical set for Blk 1, 2, 3 & MSCP)	0.9
		Wet Riser Transfer Pump (Typical set for Blk 1, 2 & 3)	110.8
		Wet Riser Main Pump (Typical set for Blk 1, 2 & 3)	46.4
		Wet Riser Jockey Pump (Typical set for Blk 1, 2 & 3)	3.5
		Irrigation System (Typical Set for MSCP)	3.5
		Utilities Centre at MSCP	0.6
		EV Charging Terminal per Lot at MSCP (Future Provision)	8.7
		EPS (at MSCP)	13.8
		SPF PER, 1 Phase, 32A (Typical set for all Blocks)	7.4
		Solar Ready Roof (Typical set for Blk 1, 2 & 3)	103.9

Sample Electrical Load Tabulation (Part 2)

Type of unit/ Type of Installation	Block Number							Remarks
	Resi Blk - 1		Resi Blk - 2		Resi Blk - 3		MSCP	
	CSR-1	CSR-2	CSR-1	CSR-2	CSR-1	CSR-2	CSR	
2 Room flat (Type 1)				46	114	138		
2 Room flat (Type 2)		69	46					
2 Room Rental Flat		46		46				
4 Room Flat	68	46	46	46				
Provision for MNO (63A TPN)					1			
Parcel Locker (20A DP)						1		
Provision for TER (32A DP)		1				1		
Provision for MDF (32A TPN)			1					
(A) Unmetered Supply (kVA)	**292**	**608**	**370**	**563**	**399**	**552**	**0**	
No. of set of Power & Public Lighting Circuit (Landscape)		1		1		1		
No. of set of Power & Public Lighting Circuit (Service Road & Driveway)		1				1		
No. of set of Power & Public Lighting Circuit (Carpark)							1	
Others:								
No. of set of Power & Public Lighting (Void Deck)	1	1	1	1	1	1		
No. of set of Power & Public Lighting (Corridor)	1		1		1			
No. of set of Power & Public Lighting (Staircase)	1	1	1	1	1	1	1	
No. of set of Lift Lobby Lightings	1	1	1	1	1	1	1	
No. of set of Power & Public Lighting (Roof Garden)							1	
No. of set of Passenger Lift	2		2		2		2	
No. of set of Fire Lift		1		1		1		
No. of set of Domestic Transfer Pump		1		1		1		
No. of set of Domestic Booster Pump		1		1		1		
No. of set of Hose Reel Fire Fighting Pump	1		1		1		1	
No. of set of Wet Riser Booster Pump (Duty)		1		1		1		
No. of set of Wet Riser Booster Pump (Stand By)	1		1		1			
No. of set of Wet Riser Jockey Pump		1		1		1		
No. of set of Wet Riser Transfer Pump (Duty)		1		1		1		
No. of set of Wet Riser Transfer Pump (Stand By)	1		1		1			
No. of set of Irrigation System							1	
No. of set of M&E Rooms		1		1		1	1	
No. of set of Solar Ready Roof, 150A TPN	1			1		1		
No. of set of Utilities Centre							1	
No. of set of EV Charging Terminal (Future Provision)							44	
No. of set of EPS							1	
No. of set of SPF PER, 1 Phase, 32A		1		1		1	1	
No. of Set of Precinct Pavillion (200m2) (Provision of Electrical Supply - 0.74A/m2(1Ø))		1						
No. of Set of Childcare Centre, - 0.74A/ m2, 1Phase (880m2)								
(B) Metered Supply (KVA)	**468**	**222**	**330**	**267**	**331**	**248**	**600**	
Total Design Load (A+B) in KVA	**760**	**830**	**700**	**830**	**730**	**800**	**600**	
Total Design Load for Residential and MSCP (kVA)	5250							
Total Applied Load (KVA)	5250							
No. of CSR	1	1	1	1	1	1	1	
Applied Load per CSR (KVA)	760	830	700	830	730	800	600	
No./size of incoming MCCB	2 / 800A	2 / 800A	2 / 800A	2 / 800A	2 / 800A	2 / 800A	1 / 1000A	
Type & Capacity of Electrical Substation:	**Proposed 22KV/LV ESS with 4 nos. of 1.5MVA Transformer**							
Total Design Load for ESS (kVA)	**5250**							
Size of Standby Generator (if any):	600 KVA for Block 1, 2, 3 and MSCP							

Sample Transformer Loading Tabulation

Type	Block No.	Approved kVA Load Per CSR	Per Side	Transformer TF1	Transformer TF2	Transformer TF3	Transformer TF4	Remarks
Residential	BLK 1/ CSR1	760.00	380.00	380.00	380.00			Dual Intake
	BLK 1/ CSR2	830.00	415.00			415.00	415.00	Dual Intake
	BLK 2/ CSR1	700.00	350.00	350.00	350.00			Dual Intake
	BLK 2/ CSR2	830.00	415.00			415.00	415.00	Dual Intake
	BLK 3/ CSR1	730.00	365.00	365.00	365.00			Dual Intake
	BLK 3/ CSR2	800.00	400.00	400.00		400.00		Dual Intake
MSCP	MSCP/ CSR	600.00	600.00				600.00	One Single, Bulk Intake
Total Load (kVA) per Transformer				1495.00	1095.00	1230.00	1430.00	
Proposed Transformer Capacity				1.5 MVA	1.5 MVA	1.5 MVA	1.5 MVA	
Total Load (kVA) for ESS				5250				
Proposed ESS TYPE (TRANSFORMER PLINTH)				ESS-1 WITH 4 PLINTH TRANSFORMER				

Generator Design Load Tabulation

Block	No. of Sty	Fire Lift	Passenger Lift	No of Lifts	Wet Riser (Y/N)	Generator #1
1	28	1	1	2	Y	1
2	28	1	1	2	Y	1
3	28	1	1	2	Y	1
MSCP	6	0	2	2	N	1

Generator Sizing

Condition:

i) 1 Block on Fire & Power Failure, 1 Block on Power Failure

i) Ther are 3 Resi Blocksand 1 MSCP Blk sharing 1 no. standby generator set to serve the hosereel pumps, wet riser pumps and lifts

Scenario:

i) 1 Fire Pump (Hosereel Pump) for 1 Resi Block: Starting

ii) 3 Blocks + MSCP : 3 Fire Lift Running & 5 Passenger Lift Running

iii) 1 Wet Riser Pump: Starting at any Resi Block

iiv) Emergency Lighting: Runnung for all Blocks

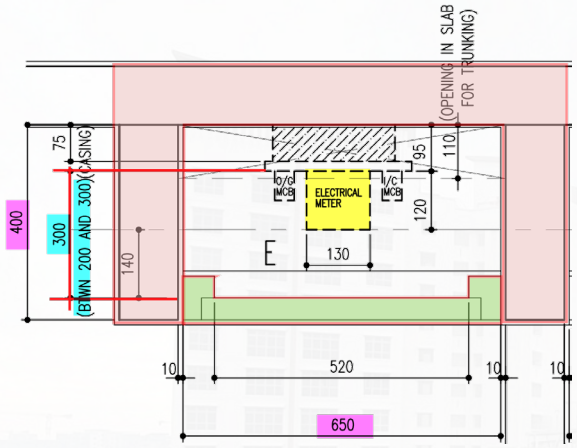
Location of Generator #1: Block (MSCP)

Block 1, 2 & 3 and MSCP sharing Generator #1

Desription	Running kVA	Starting Multiplier	Starting kVA	Numbers	kVA Load	Starting Method
1 Fire Lift for Block 1, 2 & 3 (13pax Passenger Type)	22	1.7	37.84	3	113.52	VVVF
1 Passenger Lift for Block 1, 2 & 3 (13 Pax Passenger Type)	22	1.7	37.40	3	112.2	VVVF
2 Passenger Lift for MSCP	15	1.7	25.50	2	51	VVVF
Fire Hose Reels Pump	1	1.5	1.50	1	1.5	DOL
Wet Riser Transfer Pump	110.8	1.1	121.88	1	121.88	VSD
Emergency Lighting	54	1.0	54.00	1	54	VSD
Total					**454.1**	
Proposed Size of Generator (kVA)					**600**	

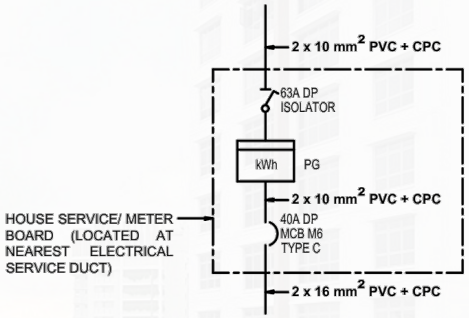
Electrical Risers

1. Minimum Size for Dwelling Units



2. Up to 2 Electrical Meters

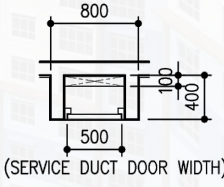
3. Electrical Meter Diagram


2 x 10 mm² PVC + CPC
63A DP ISOLATOR
kWh
PG
2 x 10 mm² PVC + CPC
40A DP MCB M6 TYPE C
2 x 16 mm² PVC + CPC
HOUSE SERVICE/ METER BOARD (LOCATED AT NEAREST ELECTRICAL SERVICE DUCT)

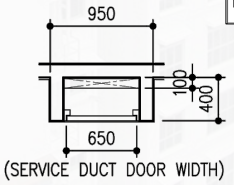
4. Common Electrical Risers (L&M Riser)

- Serving the power provision for the roof such as for Wet Riser System, Solar Ready Roof, MNO (Mobile Network System), Hosereel, Lift, etc.

For example:	
Services	Remark
Booster pump	Town Council Trunking
Hose reel pump	Min. 150mm x 100mm
Public Lighting	(Separate Trunking for Fire Resistance and Normal Cables)
Solar Panel	Solar PV Trunking (100mm x 100mm)
MNO	MNO Trunking (min. 200mm x 50mm) Note2



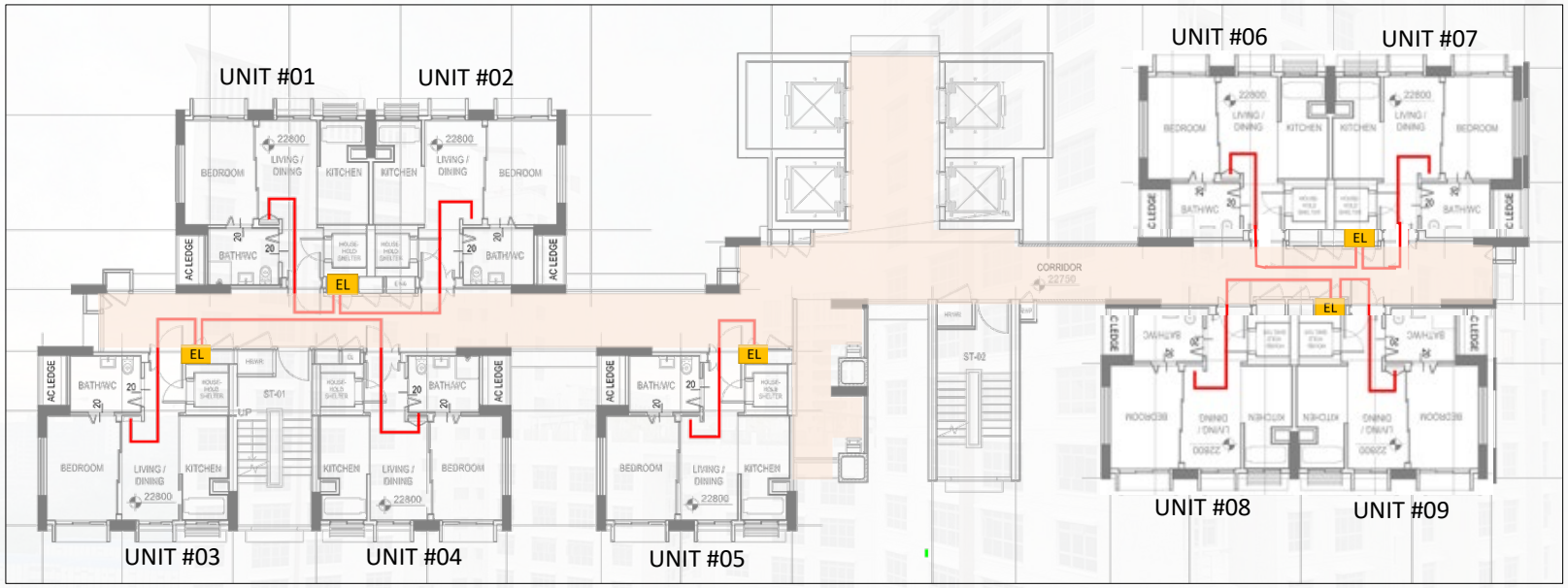
(FOR BUILDING UP TO 22 STOREY)



(FOR BUILDING FROM 22 TO 40 STOREY)

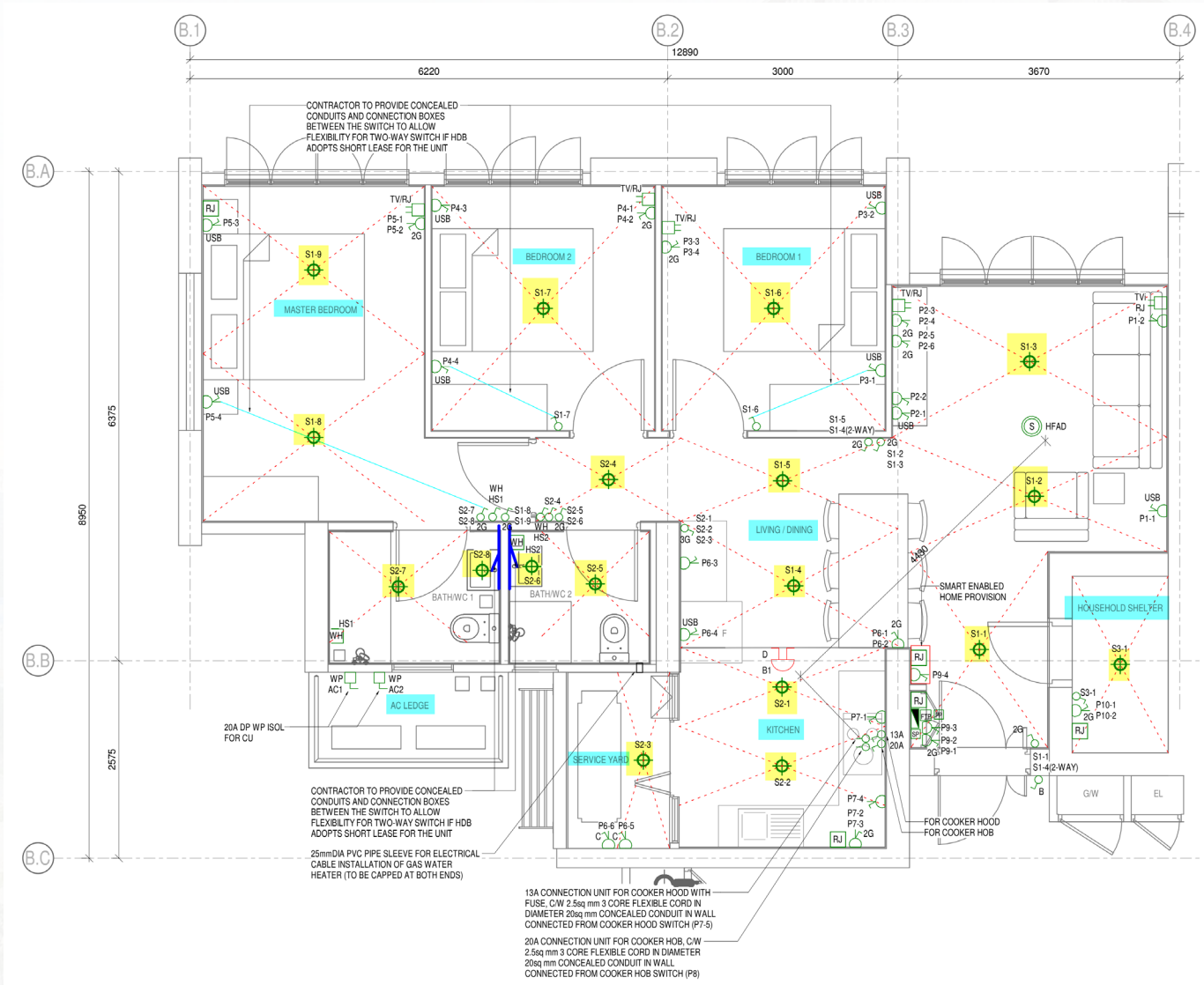
Electrical Risers

(Sample Power Distribution from Electrical Riser to Dwelling Units CCU)

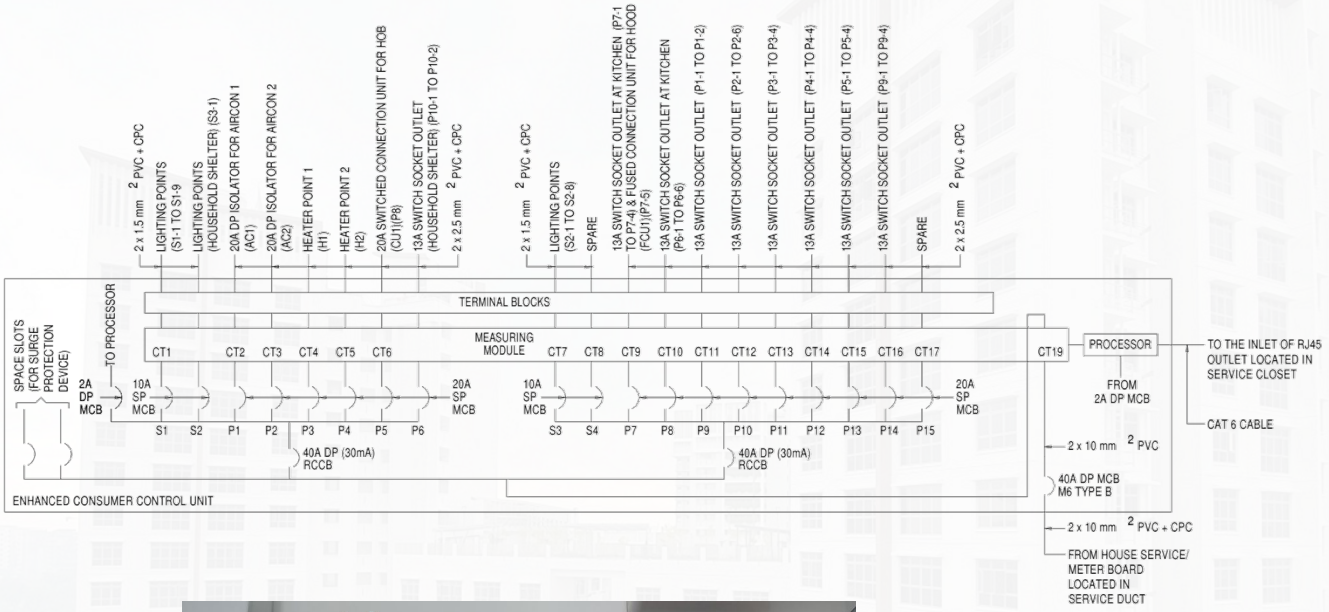


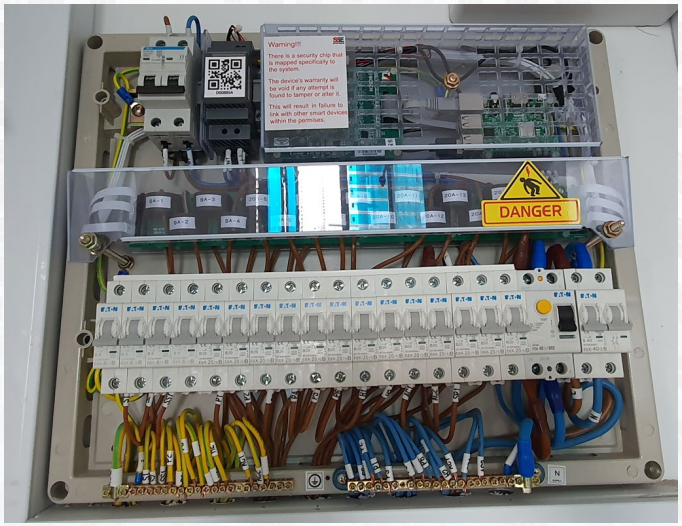
-1 NO. 25mm DIAMETER ELECTRICAL CONDUIT FOR UNIT INCOMING FROM ELECTRICAL RISER TO SERVICES CLOSET (TYPICAL TO ALL UNITS)

Sample Electrical Layout at Dwelling Units/ Flats

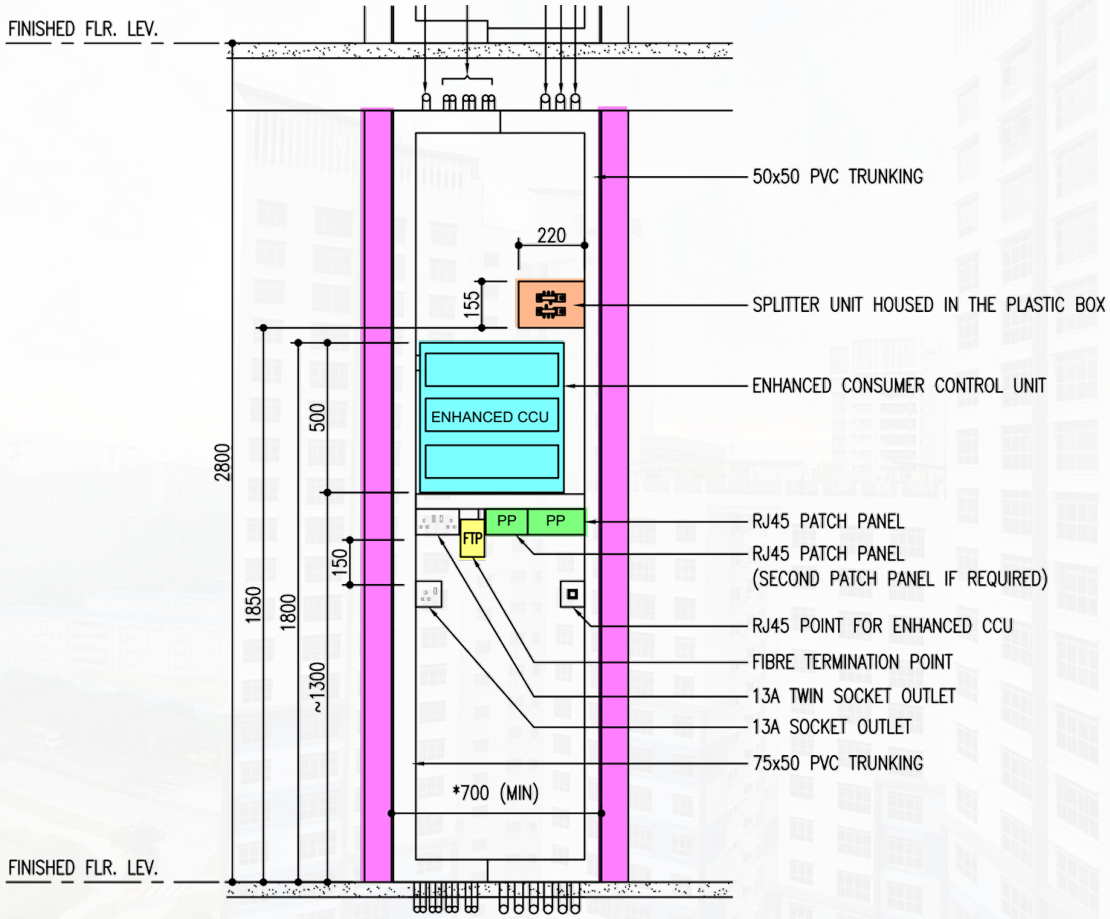

B.1
B.2
B.3
B.4
B.A
B.B
B.C
12890
6220
3000
3670
8950
6375
2575
CONTRACTOR TO PROVIDE CONCEALED CONDUITS AND CONNECTION BOXES BETWEEN THE SWITCH TO ALLOW FLEXIBILITY FOR TWO-WAY SWITCH IF HDB ADOPTS SHORT LEASE FOR THE UNIT
MASTER BEDROOM
BEDROOM 2
BEDROOM 1
LIVING / DINING
KITCHEN
SERVICE YARD
BATH/WC 1
BATH/WC 2
AC LEDGE
HOUSEHOLD SHELTER
SMART ENABLED HOME PROVISION
HFAD
20A DP WP ISOL FOR CU
CONTRACTOR TO PROVIDE CONCEALED CONDUITS AND CONNECTION BOXES BETWEEN THE SWITCH TO ALLOW FLEXIBILITY FOR TWO-WAY SWITCH IF HDB ADOPTS SHORT LEASE FOR THE UNIT
25mmDIA PVC PIPE SLEEVE FOR ELECTRICAL CABLE INSTALLATION OF GAS WATER HEATER (TO BE CAPPED AT BOTH ENDS)
13A CONNECTION UNIT FOR COOKER HOOD WITH FUSE, C/W 2.5sq mm 3 CORE FLEXIBLE CORD IN DIAMETER 20sq mm CONCEALED CONDUIT IN WALL CONNECTED FROM COOKER HOOD SWITCH (P7-5)
20A CONNECTION UNIT FOR COOKER HOB, C/W 2.5sq mm 3 CORE FLEXIBLE CORD IN DIAMETER 20sq mm CONCEALED CONDUIT IN WALL CONNECTED FROM COOKER HOB SWITCH (P8)
FOR COOKER HOOD
FOR COOKER HOB
G/W
EL

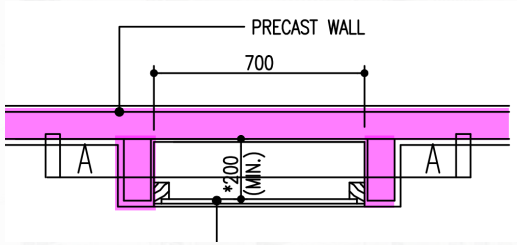
Sample SLD for Dwelling Unit/ Flats


2 x 1.5 mm 2 PVC + CPC
LIGHTING POINTS (S1-1 TO S1-9
LIGHTING POINTS (HOUSEHOLD SHELTER) (S3-1)
20A DP ISOLATOR FOR AIRCON 1 (AC1)
20A DP ISOLATOR FOR AIRCON 2 (AC2)
HEATER POINT 1 (H1)
HEATER POINT 2 (H2)
20A SWITCHED CONNECTION UNIT FOR HOB (CU1)(P8)
13A SWITCH SOCKET OUTLET (HOUSEHOLD SHELTER) (P10-1 TO P10-2)
2 x 2.5 mm 2 PVC + CPC
2 x 1.5 mm 2 PVC + CPC
LIGHTING POINTS (S2-1 TO S2-8)
SPARE
13A SWITCH SOCKET OUTLET AT KITCHEN (P7-1 TO P7-4) & FUSED CONNECTION UNIT FOR HOOD (FCU1)(P7-5)
13A SWITCH SOCKET OUTLET AT KITCHEN (P6-1 TO P6-6)
13A SWITCH SOCKET OUTLET (P1-1 TO P1-2)
13A SWITCH SOCKET OUTLET (P2-1 TO P2-6)
13A SWITCH SOCKET OUTLET (P3-1 TO P3-4)
13A SWITCH SOCKET OUTLET (P4-1 TO P4-4)
13A SWITCH SOCKET OUTLET (P5-1 TO P5-4)
13A SWITCH SOCKET OUTLET (P9-1 TO P9-4)
SPARE
2 x 2.5 mm 2 PVC + CPC
TERMINAL BLOCKS
SPACE SLOTS (FOR SURGE PROTECTION DEVICE)
TO PROCESSOR
2A DP MCB
MEASURING MODULE
CT1 CT2 CT3 CT4 CT5 CT6 CT7 CT8 CT9 CT10 CT11 CT12 CT13 CT14 CT15 CT16 CT17 CT19
10A SP MCB
20A SP MCB
S1 S2 P1 P2 P3 P4 P5 P6 S3 S4 P7 P8 P9 P10 P11 P12 P13 P14 P15
40A DP (30mA) RCCB
PROCESSOR
FROM 2A DP MCB
TO THE INLET OF RJ45 OUTLET LOCATED IN SERVICE CLOSET
CAT 6 CABLE
2 x 10 mm 2 PVC
40A DP MCB M6 TYPE B
2 x 10 mm 2 PVC + CPC
FROM HOUSE SERVICE/ METER BOARD LOCATED IN SERVICE DUCT
ENHANCED CONSUMER CONTROL UNIT


Warning!!!
There is a security chip that is mapped specifically to the system.
The device's warranty will be void if any attempt is found to tamper or alter it.
This will result in failure to link with other smart devices within the premises.
DANGER

Service Closet at Dwelling Units





Telecommunication System

TFCC (Telecommunications Facility Coordination Committee)

- A coordination platform involving agencies and telecom operators (Singtel, Starhub and NLT)

IMDA (Infocom Media Development Authority)

- Is the government authority in Singapore regulating Telecommunications, Media, etc.

COPIF 2018 (Code Of Practice for Info-Communication Facilities)

Telecommunication System

(Based on COPIF 2018 and HDB Requirements)

Where the development comprises of residential and non-residential buildings (e.g. carpark, commercial block), 1 MDF room shall be provided in one of the residential blocks.

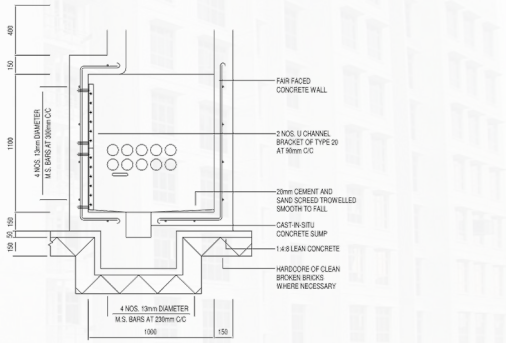
MDF Room Requirement

NOS. OF 110ø UPVC LEAD-IN PIPES (MINIMUM QUANTITY)	NO. OF UNITS	MIN. FLOOR AREA OF M.D.F. ROOMS (m^2)
10	201 – 400	20
12	401 – 600	30
14	601 – 800	42
16	801 – 1000	49
18	1001 – 1500	56

TER Room Requirement

NO. OF UNITS TO BE SERVED	MIN. FLOOR AREA OF TER (m^2)
61 – 120	6
121 – 300	8
301 – 600	10

Manhole (Section View)


FAIR FACED CONCRETE WALL
2 NOS. U CHANNEL BRACKET OF TYPE 20 AT 96mm C/C
20mm CEMENT AND SAND SCREED TROWELLED SMOOTH TO FALL
CAST-IN-SITU CONCRETE SUMP
1:4:8 LEAN CONCRETE
HARDCORE OF CLEAN BROKEN BRICKS WHERE NECESSARY
4 NOS. 13mm DIAMETER M.S. BARS AT 230mm C/C
4 NOS. 13mm DIAMETER M.S. BARS AT 300mm C/C
400
150
1100
150
150
1000
150

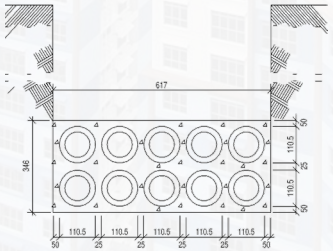
Lead-In Pipe (UTS) Requirement

TOTAL NUMBERS OF RESIDENTIAL UNITS IN THE MULTI-STOREY RESIDENTIAL BUILDING	NUMBER OF LEAD-IN PIPES
11 – 60	2 x 3
61 – 200	2 x 4
201 – 400	2 x 5
401 – 600	2 x 6

Telecom Manhole Type

Highest number of underground pipes entering any one side of the manhole	Type of manhole to be provided
≤ 2	JX2
3 to 6	MX1
7 to 9	MX2
10 to 12	MX3
13 to16	MX4
17 to 24	MX5

UTS (Section View)



TYPICAL SECTION OF 2 ROWS OF 5 NOS. PIPE FORMATION

SCALE : NTS

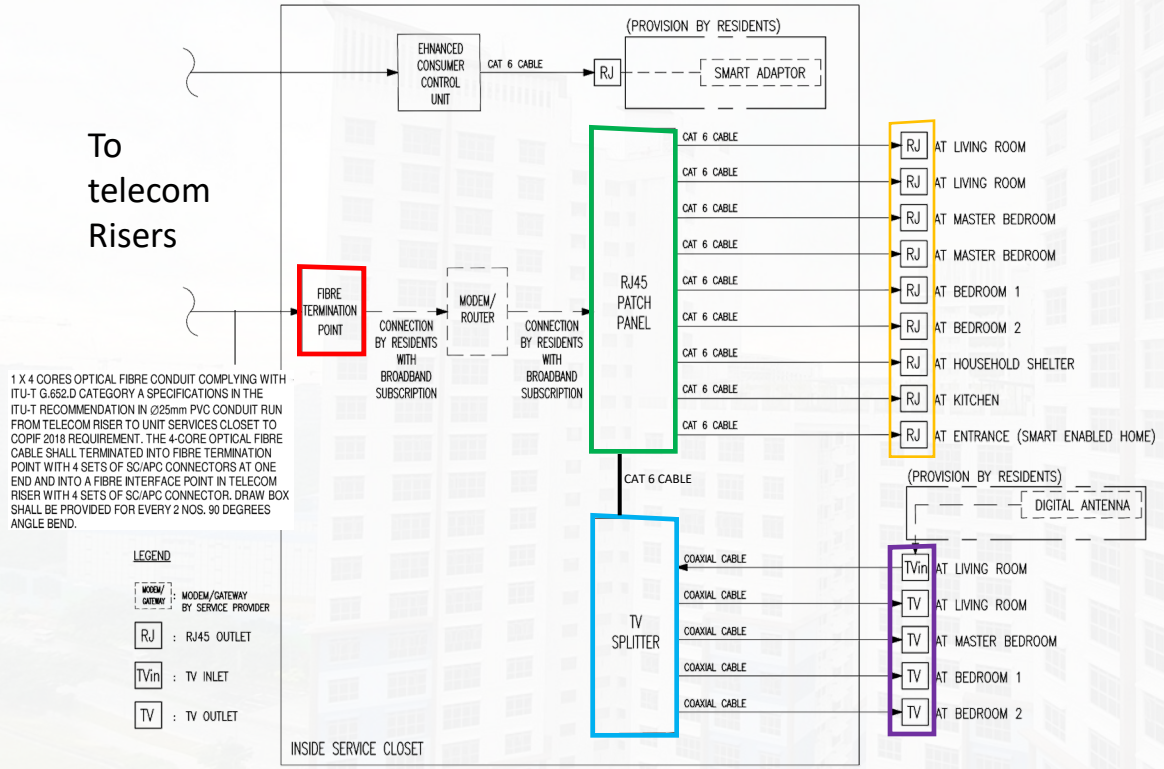
Trunking Size at Telecom Riser

Type of Metal trunkings	Minimum size of metal trunking where riser has a side wall depth of 450mm	Minimum size of metal trunking where riser has a side wall depth of 600mm
For Telecommunication (≤ 25 storeys)	300mm x 50 mm	400mm x 50 mm
For Telecommunication (between 26 and 50 storeys)	400mm x 50 mm	500mm x 50 mm

Telecommunication System

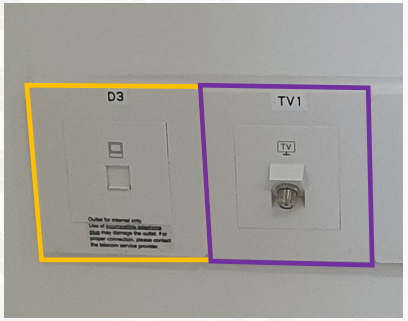
(Telecom Provisions at Typical Dwelling Units)

Schematic Diagram


To telecom Risers
EHNANCED CONSUMER CONTROL UNIT
CAT 6 CABLE
RJ
(PROVISION BY RESIDENTS)
SMART ADAPTOR
FIBRE TERMINATION POINT
CONNECTION BY RESIDENTS WITH BROADBAND SUBSCRIPTION
MODEM/ ROUTER
CONNECTION BY RESIDENTS WITH BROADBAND SUBSCRIPTION
RJ45 PATCH PANEL
CAT 6 CABLE
AT LIVING ROOM
AT LIVING ROOM
AT MASTER BEDROOM
AT MASTER BEDROOM
AT BEDROOM 1
AT BEDROOM 2
AT HOUSEHOLD SHELTER
AT KITCHEN
AT ENTRANCE (SMART ENABLED HOME)
1 X 4 CORES OPTICAL FIBRE CONDUIT COMPLYING WITH ITU-T G.652.D CATEGORY A SPECIFICATIONS IN THE ITU-T RECOMMENDATION IN Ø25mm PVC CONDUIT RUN FROM TELECOM RISER TO UNIT SERVICES CLOSET TO COPIF 2018 REQUIREMENT. THE 4-CORE OPTICAL FIBRE CABLE SHALL TERMINATED INTO FIBRE TERMINATION POINT WITH 4 SETS OF SC/APC CONNECTORS AT ONE END AND INTO A FIBRE INTERFACE POINT IN TELECOM RISER WITH 4 SETS OF SC/APC CONNECTOR. DRAW BOX SHALL BE PROVIDED FOR EVERY 2 NOS. 90 DEGREES ANGLE BEND.
(PROVISION BY RESIDENTS)
DIGITAL ANTENNA
TV SPLITTER
COAXIAL CABLE
TVin
TV
AT LIVING ROOM
AT LIVING ROOM
AT MASTER BEDROOM
AT BEDROOM 1
AT BEDROOM 2
LEGEND
MODEM/ GATEWAY : MODEM/GATEWAY BY SERVICE PROVIDER
RJ : RJ45 OUTLET
TVin : TV INLET
TV : TV OUTLET
INSIDE SERVICE CLOSET

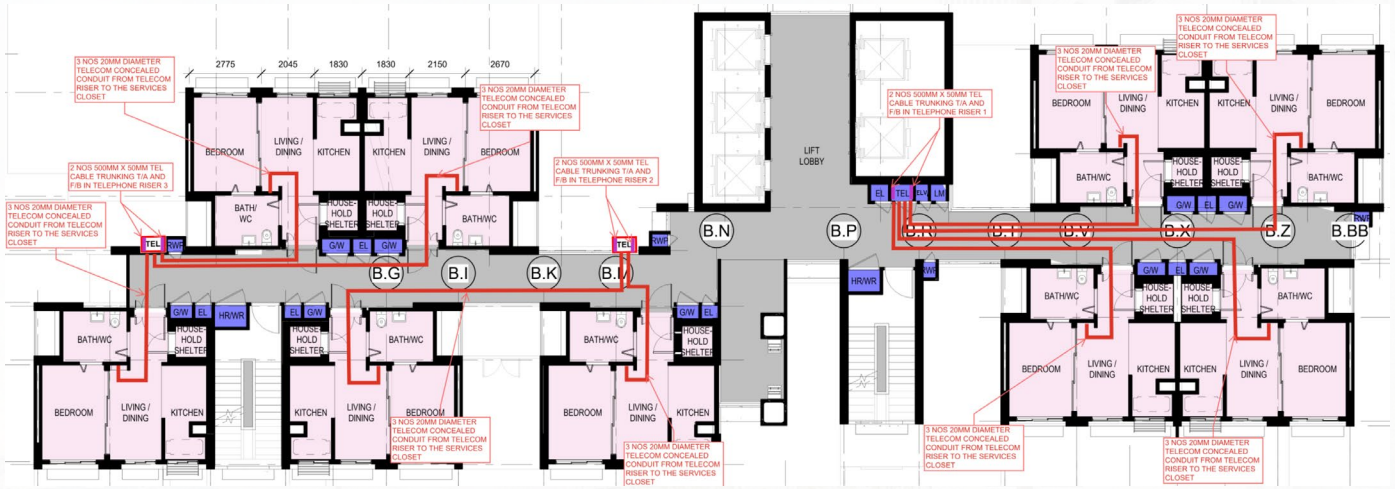
At Service Closet

RJ45 & TV Point



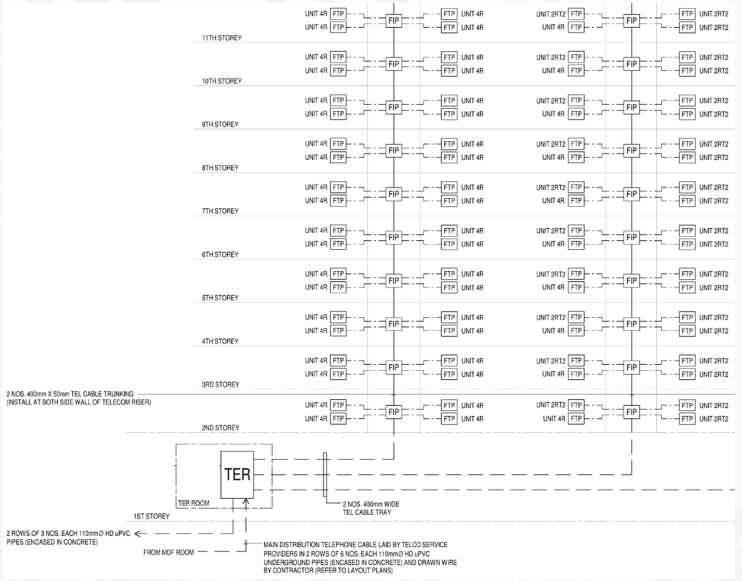
Telecommunication System

Sample Telecom Distribution Layout to Dwelling Units

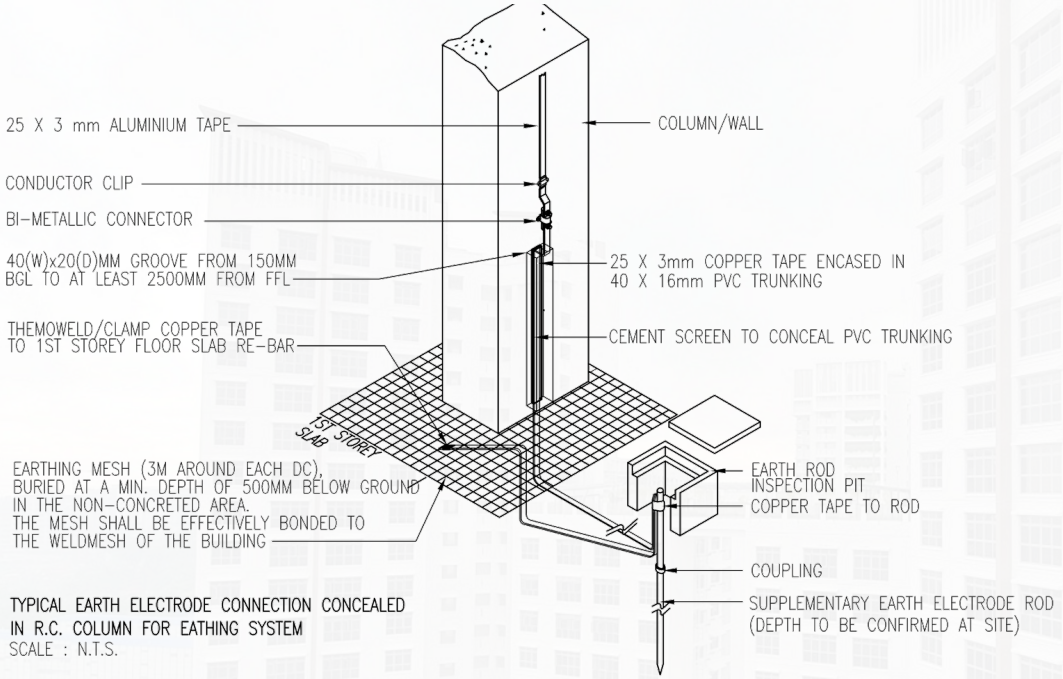


FIP (Fiber Interface Point) At Telecom Riser

Sample Schematic Diagram


11TH STOREY
10TH STOREY
9TH STOREY
8TH STOREY
7TH STOREY
6TH STOREY
5TH STOREY
4TH STOREY
3RD STOREY
2ND STOREY
1ST STOREY
UNIT 4R
UNIT 2RT2
FTP
FIP
TER
TER ROOM
2 NOS. 400mm WIDE TEL CABLE TRAY
2 NOS. 400mm X 50mm TEL CABLE TRUNKING (INSTALL AT BOTH SIDE WALL OF TELECOM RISER)
2 ROWS OF 3 NOS. EACH 110mm Ø HD uPVC PIPES (ENCASED IN CONCRETE)
FROM MDF ROOM
MAIN DISTRIBUTION TELEPHONE CABLE LAID BY TELCO SERVICE PROVIDERS IN 2 ROWS OF 6 NOS. EACH 110mm Ø HD uPVC UNDERGROUND PIPES (ENCASED IN CONCRETE) AND DRAWN WIRE BY CONTRACTOR (REFER TO LAYOUT PLANS)

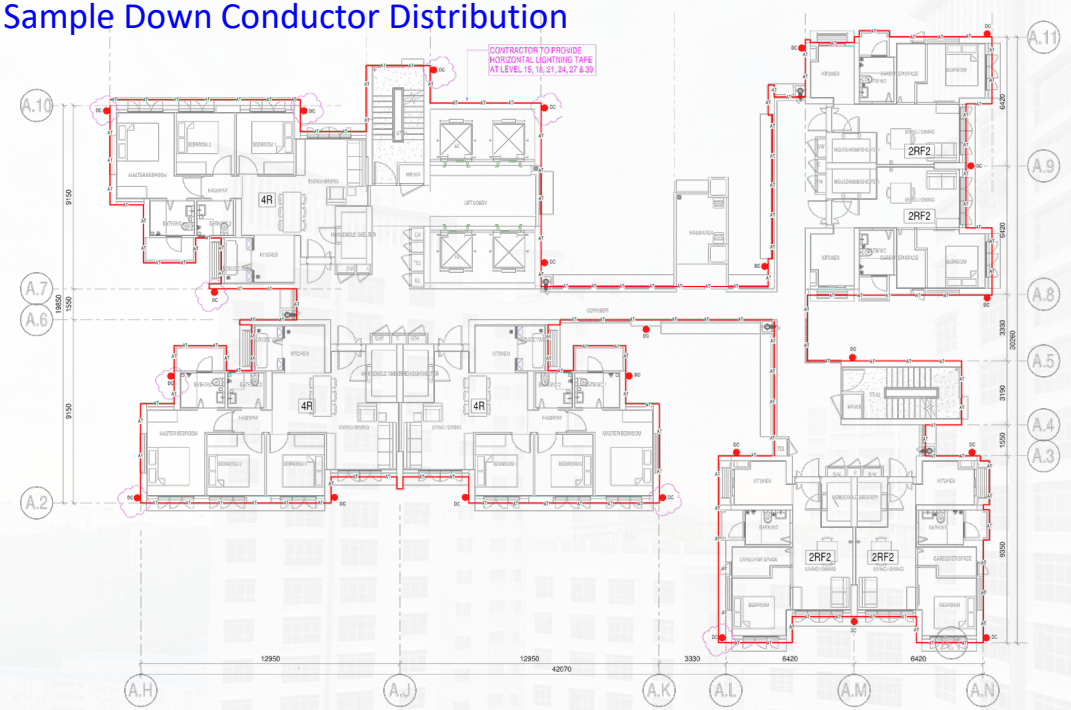
Lightning Protection System (LPS)


25 X 3 mm ALUMINIUM TAPE
COLUMN/WALL
CONDUCTOR CLIP
BI-METALLIC CONNECTOR
40(W)x20(D)MM GROOVE FROM 150MM BGL TO AT LEAST 2500MM FROM FFL
25 X 3mm COPPER TAPE ENCASED IN 40 X 16mm PVC TRUNKING
THEMOWELD/CLAMP COPPER TAPE TO 1ST STOREY FLOOR SLAB RE-BAR
CEMENT SCREEN TO CONCEAL PVC TRUNKING
1ST STOREY SLAB
EARTHING MESH (3M AROUND EACH DC), BURIED AT A MIN. DEPTH OF 500MM BELOW GROUND IN THE NON-CONCRETED AREA. THE MESH SHALL BE EFFECTIVELY BONDED TO THE WELDMESH OF THE BUILDING
EARTH ROD INSPECTION PIT
COPPER TAPE TO ROD
COUPLING
SUPPLEMENTARY EARTH ELECTRODE ROD (DEPTH TO BE CONFIRMED AT SITE)

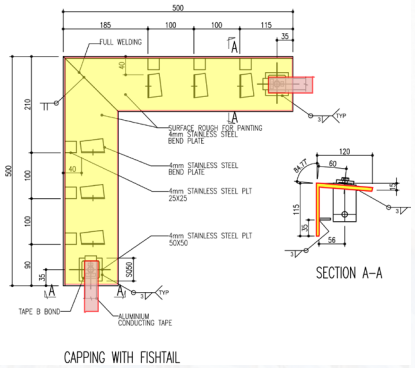
TYPICAL EARTH ELECTRODE CONNECTION CONCEALED IN R.C. COLUMN FOR EATHING SYSTEM
SCALE : N.T.S.

Lightning Protection System (LPS)

Sample Down Conductor Distribution



LPS Metal Capping at Roof



CAPPING WITH FISHTAIL

Equipotential Bonding

Equipotential Bonding shall be considered:

i) All weldmesh (BRC) shall be interconnected
ii) On the roof of the building, weldmesh (BRC) shall be connected to the air termination network
iii) On the ground floor, weldmesh (BRC) (in the floor/linkway/apron etc.) shall be effectively connected to down conductor/earthing-conductor
iv) The vertical cottering bars, extend beyond to the next floor, shall be fastened to the closest precast components and at the overlapping of the two cottering bars

Equipotential bonding to all the welded-mesh (BRC) on the roof slab shall be provided for communal facilities on top of the roof (roof/terrace garden, hardcourts, playground, trellis, shelters), MSCP, link-bridge etc.

All metallic columns, lighting column, metallic railings shall be electrically bonded to weldmesh (BRC) and connected to the main lightning protection system. Every weldmesh (BRC) shall be tag-welded to each of its adjoining weldmesh (at least 2 points).

All metallic fixtures such as air con ledge/balcony railings, window frames or the like shall also be effectively tied (electrically bonded) to the weldmesh/BRC/rebar and connected to the LPS.

Welding, clamping, overlapping or lashing etc. shall be considered to interconnect the steelwork within the precast component or steel bar and between two precast components or steel bar for electrical continuity.

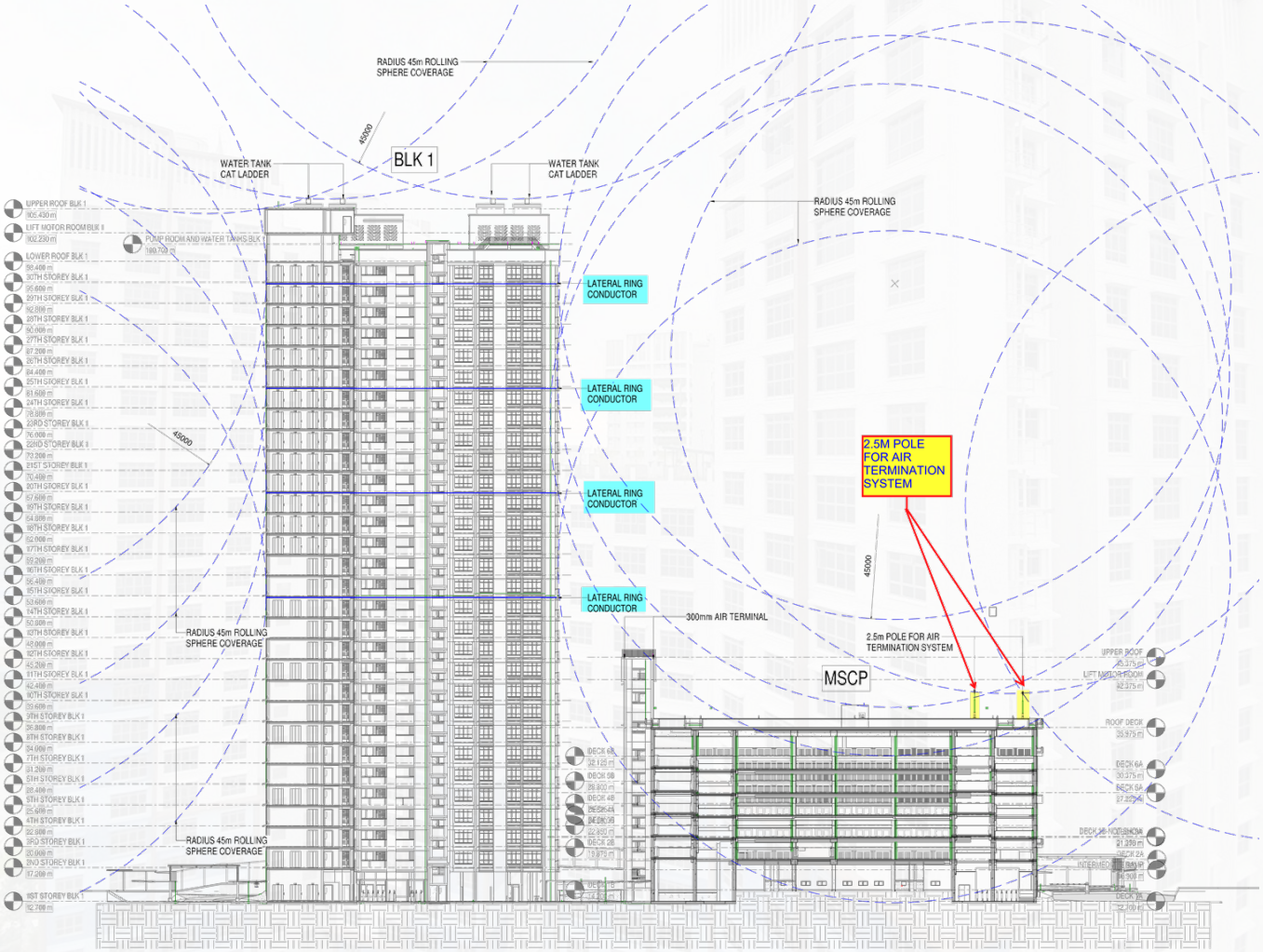
Equipotential Netting

Equipotential nettings shall be provided for playground, hardcourt, fitness station, communal facilities such as roof/terrace gardens, roof of building or the like with reinforced concrete base.

The Consultant shall ensure electrical continuity of the weldmesh/BRC used to form the equipotential surface and all metallic poles and elements within the surface are properly bonded to the weldmesh/BRC.

The Consultant shall provide the necessary photographs from the Contractor to prove that equipotential nettings are provided. It shall include equipment and metallic fixtures are bonded. In addition, the Consultant's LEW or PE shall submit a certification form (HDB-TM (M&E)-EQNET) (Annex D) to HDB and confirm equipotential nettings have been provided for the playground/hardcourt/fitness station in accordance with SS 555 upon completion of the work.

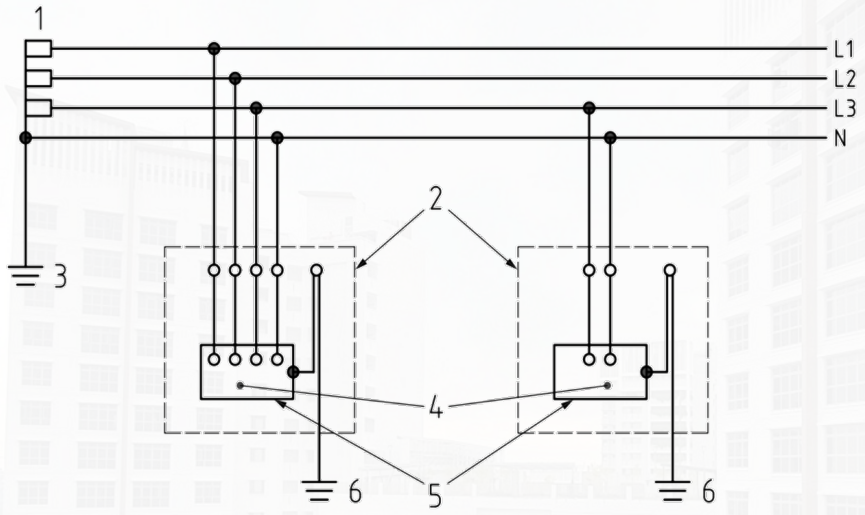
Lightning Protection System (LPS)



Sample Rolling Sphere Diagram

Earthing System

Based on T-T System since the development receive electricity supply at 400V.

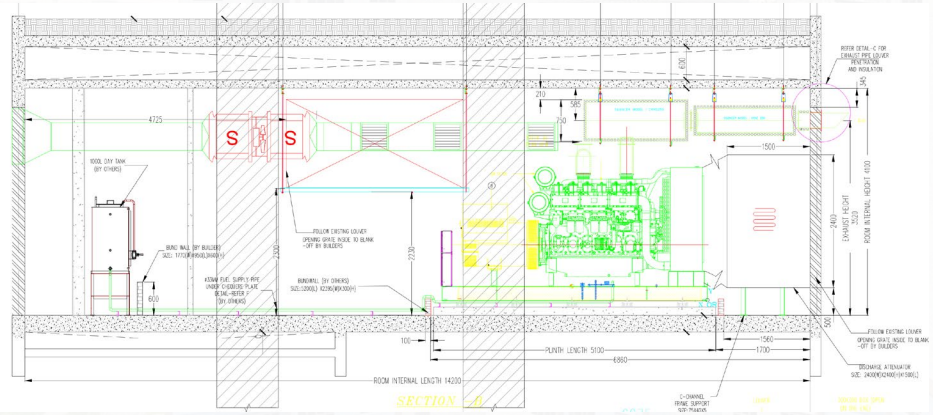


Key

1	Source of energy	4	Equipment in installation
2	Consumers' installations	5	Exposed-conductive-parts
3	Source earth	6	Installation earth electrode

Generator Requirements

- Generator room **shall not be located under a residential block**
- **Naturally ventilated**
- Complied with Fire Code 2023 Clause 6.6.6b & SS550 Clause 13.1.1.2 **where firelift & 1 non-firelift brought down concurrently.**
- The daily service fuel tank shall have capacity sufficient for storing fuel to run the engine continuously for **<u>at least 6 hours</u>** under normal full load conditions.

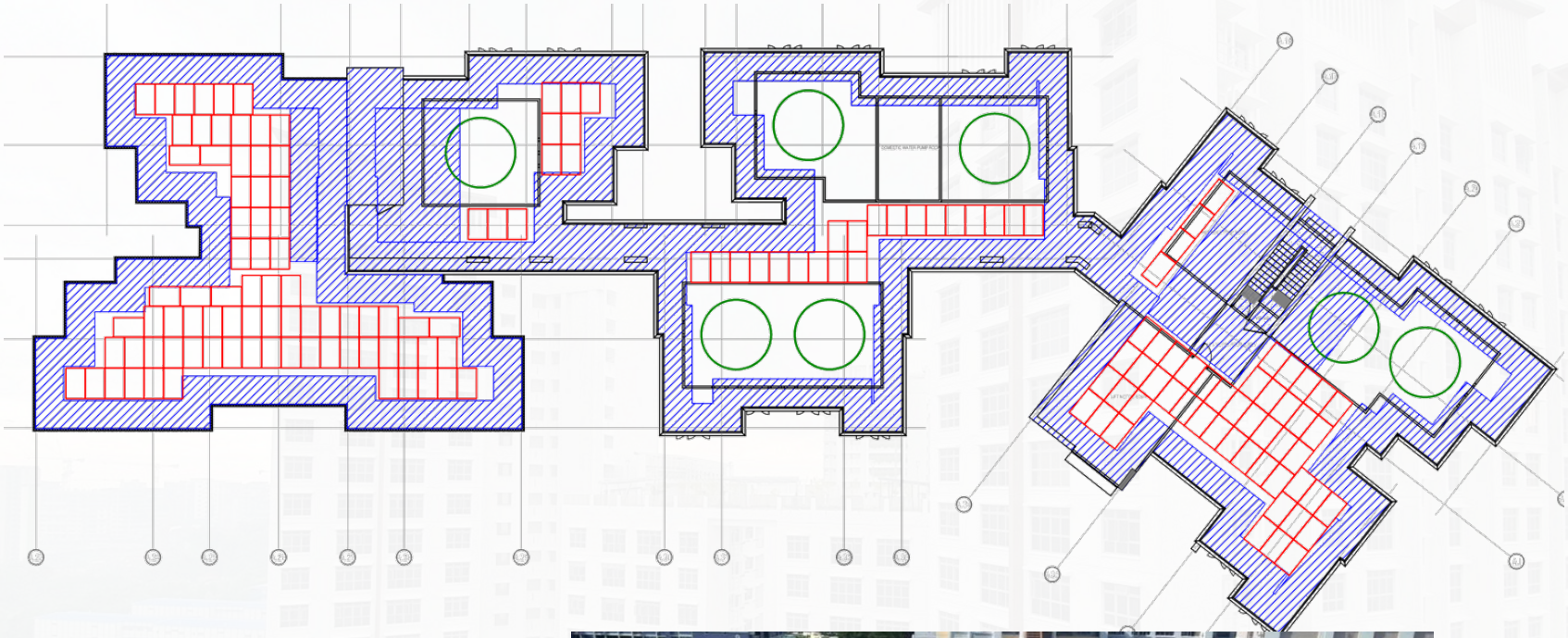


UPS (Underground Piping System) For Emergency Supply-

FROM GENSET ROOM TO EVERY BLOCK CSR (Sample Layout)

2 ROWS OF 5 NOS. EACH 150MM DIA. HD uPVC PIPE C/W WITH DRAW WIRES ENCASED IN CONCRETE WITH PVC COVER PLATE
2 ROWS OF 3 NOS. EACH 150MM DIA. HD uPVC PIPE C/W WITH DRAW WIRES ENCASED IN CONCRETE WITH PVC COVER PLATE
2 ROWS OF 2 NOS. EACH 150MM DIA. HD uPVC PIPE C/W WITH DRAW WIRES ENCASED IN CONCRETE WITH PVC COVER PLATE
2 ROWS OF 7 NOS. EACH 150MM DIA. HD uPVC PIPE C/W WITH DRAW WIRES ENCASED IN CONCRETE WITH PVC COVER PLATE
2 ROWS OF 12 NOS. EACH 150MM DIA. HD uPVC PIPE C/W WITH DRAW WIRES ENCASED IN CONCRETE WITH PVC COVER PLATE
2 ROWS OF 2 NOS. EACH 150MM DIA. HD uPVC PIPE C/W WITH DRAW WIRES ENCASED IN CONCRETE WITH PVC COVER PLATE
2 ROWS OF 5 NOS. EACH 150MM DIA. HD uPVC PIPE C/W WITH DRAW WIRES ENCASED IN CONCRETE WITH PVC COVER PLATE
2 ROWS OF 3 NOS. EACH 150MM DIA. HD uPVC PIPE C/W WITH DRAW WIRES ENCASED IN CONCRETE WITH PVC COVER PLATE
BLOCK 1
BLOCK 2
ESS
MSCP
GENSET ROOM
CSR
MDF
WRT
DWT
CSR-1
CSR-2
CSR-3
EFS
AFS
2-5 PG
6-12 PG
PP
PRECINCT PAVILION
PPSO
5M PLANTING STRIP
PLANTING
1:25.000

Solar Ready Future Space at Roof



LEGENDS:

SOLAR PANEL (FUTURE SPACE)
(Size: 1.6 X1.0m)

1.5M Clearance from building perimeter with facade and 3M Clearance from the staircase

Required Provision:

- ❑ Space at Roof
- ❑ 1 no. of 150A TPN

Mobile Network System by MNO Operator

- For boosting/ improving the mobile signal
- MNO Service Providers (Singtel, Starhub, M1 & Simba)

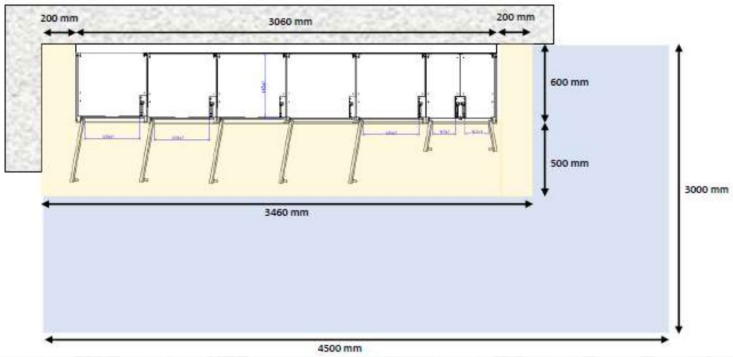
Required Electrical Provision:

- ❑ Electrical Power Requirement: 63A 3 Phase Isolator at Roof tap at the Un-metered part of MSB
- ❑ Metering Board provision
- ❑ 200mmx50mm trunking provision at common electrical riser

Parcel Locker

No of Blocks in the Precinct	No of Parcel Locker
1 to 3 blocks	1
4 to 6 Blocks	2
7 to 9 blocks	3

No of Dwelling Units in Cluster	No of Columns per Locker Station	Est No of Compartments
<= 600	5	49
601 to 750	6	58



Required Provision:

- ❑ 20A DP Isolator power supply provision tap from un-metered bus bar provided with meterboard
- ❑ Flexible GI conduit from nearby suitable Telecom Riser, for future fiber provision connection

Lighting System for Common Area

Smart Lighting	Non Smart Lighting
i) Indoor	i) Indoor
Void Deck, Corridor, Lift Lobby, Stairwell, Carpark, circulation, area, Building ingress/egress etc.	Services Room (CSR, ESS, MDF, TER, Pump Room, Generator Room, etc.)
ii) Outdoor	ii) Outdoor
Roof Garden Service Road/Driveway Landscape/Footpaths Loading Bay Linkway/Linkbridge Shelter/Stairs/ Stair landing Building entrance/exit Precinct Pavilion Playground*/Fitness Station*, Harcourt*/Multipurpose court* Loading bay	-Signage** (Block signage, signage board, notice board etc.) -Precinct marker** -Roof top walkway/ services room
Note: 1.*Do not require auto dimming during T5& T6 timing 2. ^ For LED Lighting (Smart) - Analogue timers are required 3. **For LED Lighting (Non-Smart) - Analogue timers and photocell sensors are required	

Light Fitting Type for Common Area

Indoor Lighting (Typical Lighting Selection)	
Type of LED	Application
2ft LED	Common areas, typical floor corridor/lift lobby, stairwell/half landing, central refute chute area, linkway, MSCP, linkway etc
4ft LED	1st floor common area/void deck/ community living room, basement carpark (enclosed)
2ft LED with High Lumen (>1100lumen)	MSCP carpark driveway
4ft LED with High Lumen (>2000Lm)	Carpark ramps, exits, entrances
4ft T8 LED Lighting/ 4ft T8 with battery LED Lighting	Services Room, Roof Top Lighting
Fully shielded wall mounted light fixture	Intermediate Refuge Floor (To avoid glare to opposite units)
Outdoor Lighting	
Outdoor LED Fully Shielded Light Fixture with 6m lighting pole	Driveway/Service Road
Outdoor LED Fully Shield Light Fixture with 3.5m lighting pole	Landscape, playground, footpath etc
Wall lighting	1st floor common area/void deck Note1 Outside Centralise Refuse Chute Mid Sky Terrace
Notes: 1. Wall light (<20W, <2000Lm) IP55 min. used at area where light fixture is subjected to wind-driven rain only and should not be used along corridor with < 1.5m width	

Light Fitting Correlated Colour Temperature

Correlated Colour Temperature	Application	Remarks
3000K	Service Road, Driveway Roof Garden, Sky Terrace Linkway, Shelter, Trellis, Footpath	Outdoor
4000K	Residential/Commercial corridor, MSCP, Services Room, Precinct Pavilion	Indoor
4000K	Hardcourt	Outdoor

Emergency Light/ Exit Light

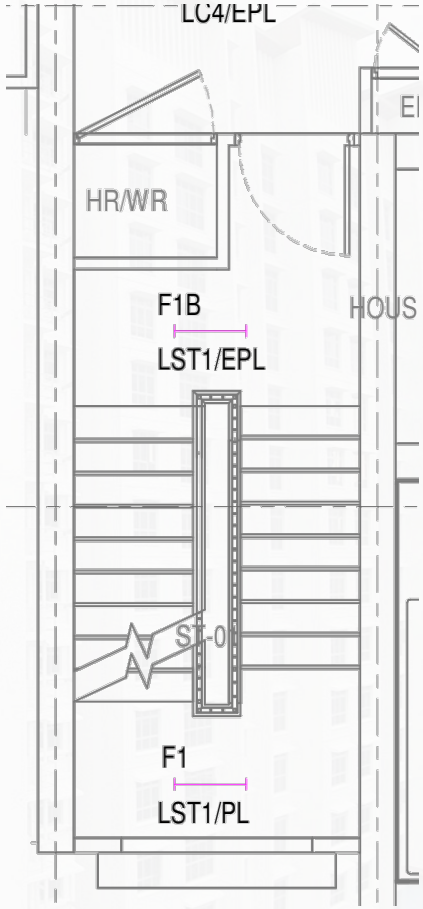
Emergency lighting design shall comply with Code of Practice SS 563 and Fire Code "Fire Precautions for Buildings". The battery for emergency/exit lighting operation shall be rated for a minimum continuous period of 2 hours.

Emergency lighting shall be provided for firefighting facilities and common area such as fire hose reel, breeching inlet, stair case, typical corridor (2FT with battery pack), carpark driveway and ramp, roof garden fire hosereel, community living room, lift lobby etc.

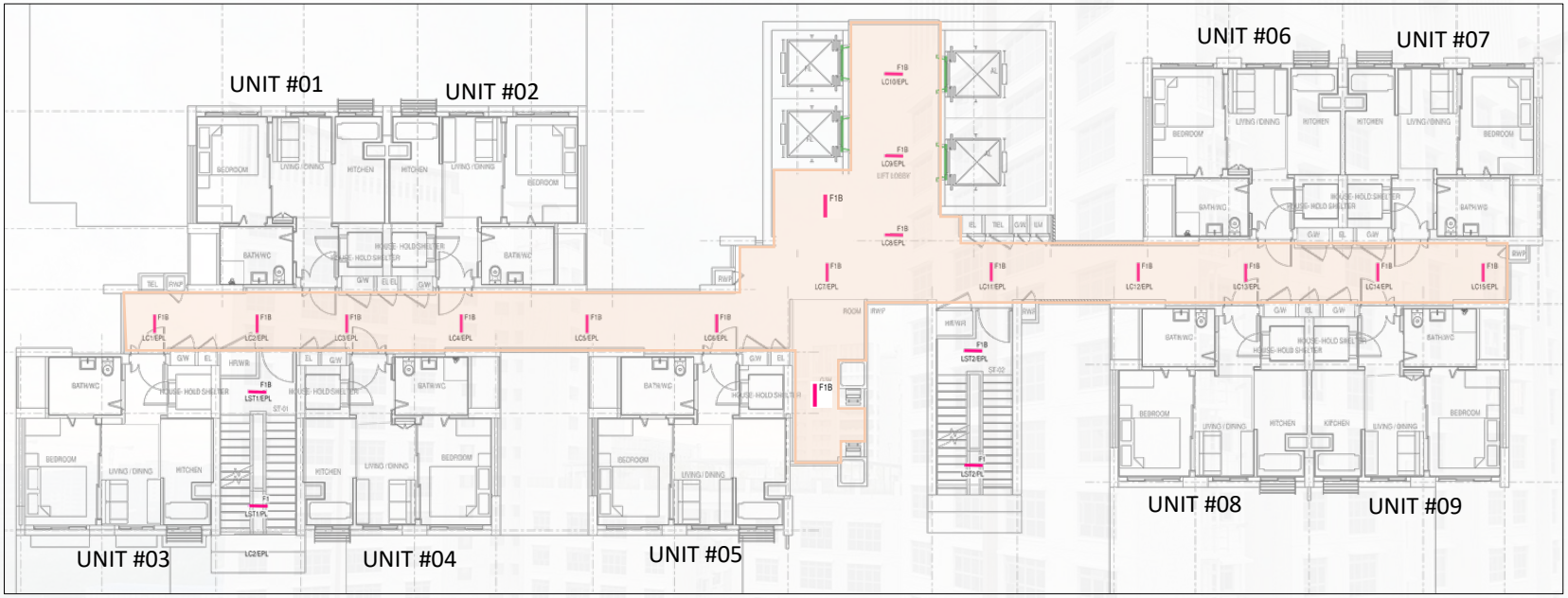
Provision of emergency light at every landing of staircase for all group (i.e. commercial premises) except residential building (i.e. no emergency lighting required at half landing for residential building).

Exit sign light shall be of white LED type.

Exit directional signs shall be provided for building including SPPG's substations etc.



Sample Lighting Layout at Corridor of Typical Floor



Aviation Obstruction Light (AOL)

Aviation obstruction light (AOL) if provided shall comply with Civil Aviation Authority of Singapore (CAAS) and Ministry of Defence (Mindef) requirements. AOL shall be of the LED type. CAAS or DSTA written confirmation shall be submitted to HDB if AOL is to be provided for the project.

Aviation control panel shall be wall mounted and located at the consumer switch room. Failure of AOL shall send a signal to HDB Smart Hub via the PLC in smart switchboard (PCFDMS) at the consumer switch room.

Lux Level Requirements

	AREA	MAINTAINED AVERAGE LEVEL (lux)	POSITION OF MEASUREMENT	DESIGN CONSIDERATIONS
1	**RESIDENTIAL BLOCK**			
i	Ground Floor Void Area */ Building Entrance/Exit	30	Floor	Consider obstructions by columns. UR = 0.3
ii	Ground Floor Lift Lobby */ Drop-off Porch	80	Floor	Consider need of day time lighting
iii	Upper Floor Corridor	20	Along Center-line	Avoid glare to flat's bedrooms
iv	Upper Floor Lift Lobby *	50	Floor	Consider need of day time lighting
v	Stairs *	30	Along Center-line	Consider need of day time lighting for totally enclosed staircase
vi	Letter Box Area	100	Floor	
vii	Community Living Room	150	Floor	
2	**OUTDOOR AMENITIES**			
i	Linkways *	10	Along Center-line	To be compatible with adjacent lit areas. UR = 0.25
ii	Precinct Pavilion - General lighting *	30	Floor	i). Provide local activity lighting ii). Ensure overall lighting coverage
	Precinct Pavilion - Function lighting	300	Floor	i). Manual switching ii). Ensure vandal proof light fittings are used
iii	Courts	100	Court Surface	Avoid glare to flat's bedrooms. UR = 0.2
iv	Playground/Fitness Corner	40	Unfurnished Surface	Avoid glare to flat's bedrooms. UR = 0.1
v	Footpath	10	Path Surface	Identify thoroughfares for security lighting provision. Shall consider alternate circuits
3	**ROADWAYS**			
i	Driveway to MSCP/Loading Bay	10	Along Center-line	i) Avoid direct glare to flat's bedrooms ii) Highlight entrance iii) Avoid glare to flat's bedrooms
ii	Service Roads to Block	10	Along Center-line	
iii	Fire Engine Accessway/Footpath	10	Along Center-line	Lighting should be provided if it is designated as footpath also.
4	**COVERED CAR PARK**			
i	Exits/Entrance	80	Exits/Entrance Surface	Avoid direct glare to traffic and consider need of day time lighting
ii	Ramps/Corners	60	Ramps/Corners Surface	Avoid direct glare to traffic and consider need of day time lighting
iii	Driveway	30	Driveway Surface	Avoid direct glare to traffic and consider need of day time lighting
iv	Parking Lot	15	Car Park Surface	
v	Roof Deck	10	Car Park Surface	Avoid glare to flat's bedrooms
vi	Stairs	30	Along Center-line	
5	**SURFACE CAR PARK**			
i	Residential, Industrial,	10	Car Park Surface	Avoid glare to flat's bedrooms
ii	Commercial Centre			Refer to PLG's Design Brief

NOTES

1. Local activity areas shall be identified and appropriate lighting level provided e.g. for reading activity, task lighting level is 150 lux.
2. For areas marked with * , shall consider a 50 % reduction in lighting level after midnight (for energy conservation)
3. UR = Uniformity Ratio = Min Illum./Ave Illumin.
4. Cover car park* refers to HDB's Multi-storey carpark (MSCP). Lighting level shall comply with SS 531 for commercial and basement carpark.
5. Lighting level along entire commercial corridor (Supermarket, shops etc.) shall comply with PLG's Design Brief.
6. Smart Lighting – Dim Level set to 30%.

Lighting Time Operation

SETTING	MONTH	SWITCH-ON TIMINGS	AREA OF APPLICATION (TYPICALLY AT DEVELOPMENTS PROJECTS)
T1	JAN TO MAR	1910 - 0700	CORRIDOR, STAIRCASE, VOID DECK, MSCP (50%- Void Deck and 1st Sty Lift Lobby) (100%- All Sty Corridor & Typical Lift Lobby) (50%- Staircase Main Landing Ltg is only On)
	APR TO JUN	1900 - 0700	
	JUL TO AUG	1910 - 0700	
	SEP	1900 - 0700	
	OCT TO NOV	1900 - 0650	
	DEC	1900 - 0700	
T2	JAN TO MAR	1910 - 0000	STAIRCASE, VOID DECK, MSCP (100%- Void Deck and 1st Sty Lift Lobby) (100%- Staircase All Ltg is On, after midnight the mid-landing Ltg will be off)
	APR TO JUN	1900 - 0000	
	JUL TO AUG	1910 - 0000	
	SEP TO DEC	1900 - 0000	
T3	JAN TO MAR	1910 - 0700	SURFACE CARPARK, SERVICE ROAD, DRIVEWAY, PRECINCT MARKER, LINKWAY, PAVILION, (LINKBUILDING), FOOTPATH, PARK, AVIATION OBSTRUCTION LIGHT
	APR TO JUN	1900 - 0700	
	JUL TO AUG	1910- 0700	
	SEP	1900- 0700	
	OCT TO NOV	1900- 0650	
	DEC	1900 - 0700	
T4	JAN TO MAR	1910 - 0000	LINKWAY, FOOTHPATH, PARK, PAVILION, (LINKBUILDING/SHELTER) Only 50% of Lightings are ON after midnight for PP (General), Roof Garden, Footpath, Landscape, Linkway, Shelter, etc. c
	APR TO JUN	1900 - 0000	
	JUL TO AUG	1910 - 0000	
	SEP TO DEC	1900 - 0000	
T5	JAN TO MAR	1910 - 2200	PLAYGROUND, GAMES COURT
	APR TO JUN	1900 - 2200	
	JUL TO AUG	1910 - 2200	
	SEP TO DEC	1900 - 2200	
T6	JAN TO MAR	1910 - 2200 & 0400 - 0700	FITNESS CORNER, PARK
	APR TO JUN	1900 - 2200 & 0400 - 0700	
	JUL TO AUG	1910 - 2200 & 0400 - 0700	
	SEP	1900 – 2200 & 0400 - 0700	
	OCT TO NOV	1900 – 2200 & 0400 - 0650	
	DEC	1900 - 2200 & 0400 - 0700	
24 HRS		24 HRS	RELATIVELY DARK/ENCLOSED LOBBY, CORRIDOR, STAIRCASE, MSCP